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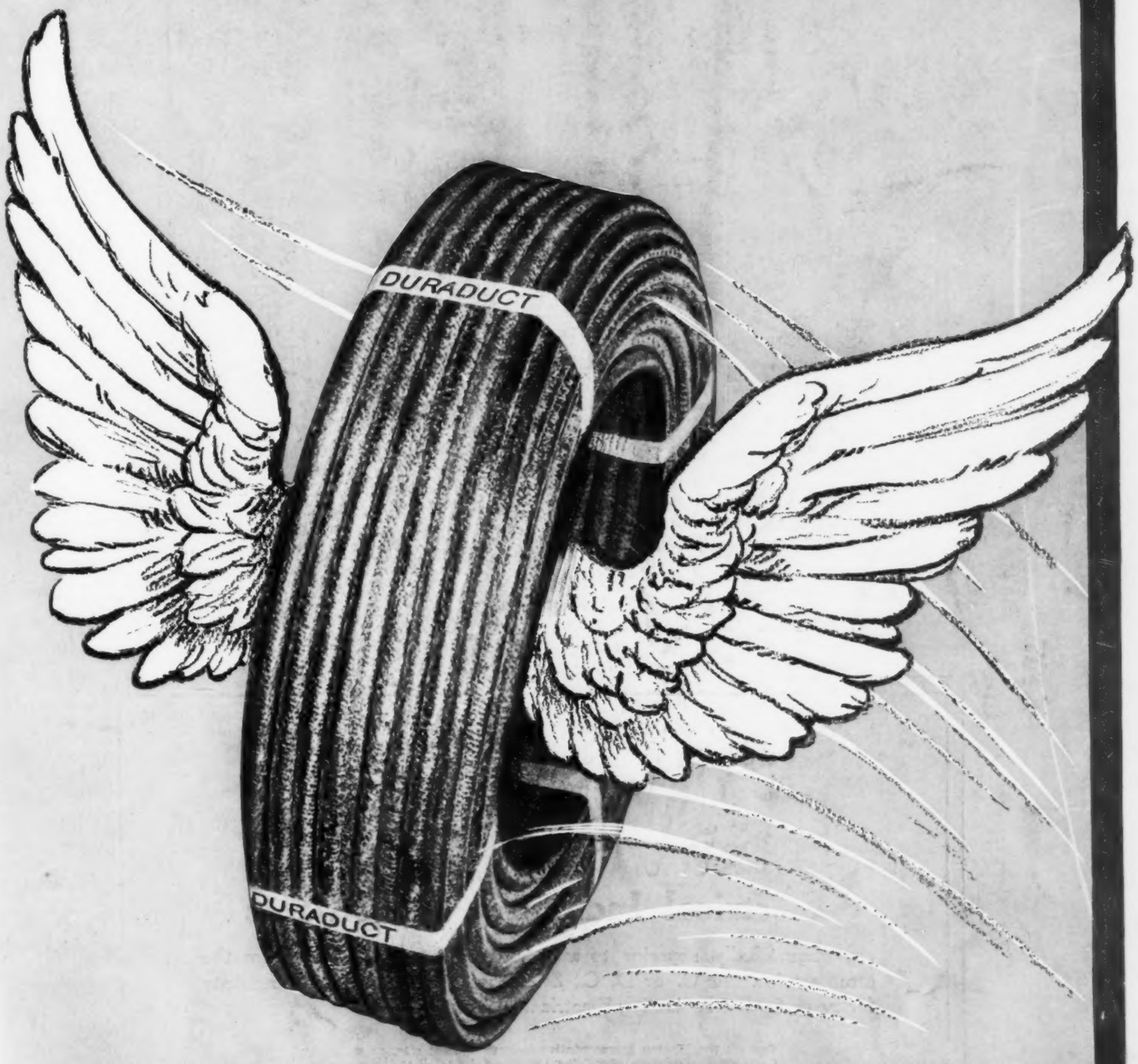

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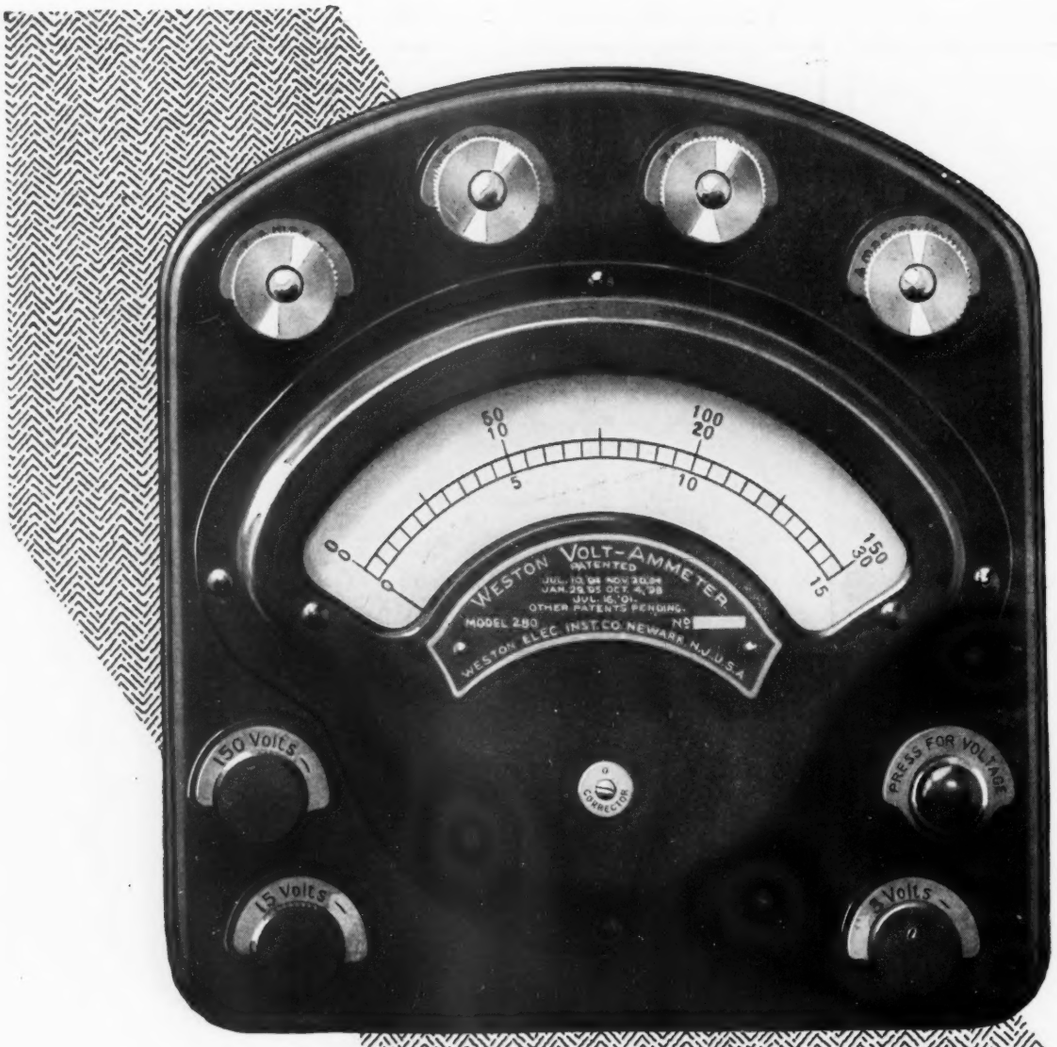

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 73 — New York, Saturday, March 8, 1919 — *Number* 10

Passing the Obligation

CONGRESS ended the allotted number of its days without taking the responsibility for crystallizing a policy for or against permanent government operation of the great utilities still controlled by the administration as a war measure. That it did nothing on this large question is attributed to several causes. People will differ about the relative weight of each, but it is well to restate them. Among them we rank first the changed attitude of the authorities after the armistice was signed. There was the plain, positive end of the war. Yet we see no action looking to the assured early return of these vast properties to their owners. Another contributing cause was the outcome of the November elections and the swing in the balance in Congress to the opposition party. While the administration party was in actual power in the legislative branch and could have forced legislation through, a new alignment has been voted by the people for the next Congress. This meant uncertainty as to how far legislation could be carried with any assurance against repeal. As another cause there is the promulgation of higher telephone rates. The state commissions saw their authority overriden in this step, and undoubtedly they contributed a powerful voice against the destruction of states' rights. This was naturally reflected in the attitude of the Representatives and Senators in Congress.

It will be observed that the causes named—together with others of similar character which had less bearing—are not economic factors. By some they might be called public policy, but others would say that they are more political in nature. The Washington authorities have not advanced economic reasons to justify continuation of their control. Such incomplete data as to economy and efficiency under their direction as are open for consideration weigh against an extension of government control. Certainly the only real grounds on which the country ought to embark on a revolutionary program of public ownership or operation or both are economic. Those who now have their capital tied up in these properties and those who favor government operation or ownership or both should be called before the bar by the public and have opportunity given them to prove their case before any radical departure from our historic policy is encouraged. That policy is in general the development of individual initiative and through the accepted principle of regulation a restricted return on the capital used in furnishing needed public service. Important cases of public ownership in this country are mainly those where a municipal government built a plant which in part or in whole duplicated the investment of a competing system of a private company; in other words, cases of uneconomic competition. There has been no great movement except as the present government control of railroads and wire lines constitutes such a movement or the possibility of an overturn of the old policy. Present conditions, of course, do not rest on any theory of uneconomic competition; they are the aftermath of the war.

The only process through which government operation or ownership on a giant scale can be permanently incorporated into our national policy as a result of the present curious conditions is by failure to carry out the clear intent of Congress as expressed in the war measures. An opportunity was open to the same Congress which enacted those measures to repeal them or to pass new laws suitable to the conditions of peace. That opportunity Congress lost when it did not act. It is not entirely blameless for it could have proceeded on its own initiative without waiting for the development of a definite administrative policy. Its failure to act leaves a burden of obligation unshouldered at this juncture. It cannot be passed on perpetually as a disregarded problem. It appears that legislation is vitally necessary to solution, and legislation is the duty of the next Congress.

The electric fan is ready in summer because some one got ready before summer. Breezes cool the air for the tired customer because the manufacturer gaged his market long in advance, the jobber figured his probable sales, the distributers gave their orders. Look ahead!

Failure of the Water-Power Bill

NEVER in American history has there been a Congress like the Sixty-fifth, just ended. Its achievements transcended those of any of its predecessors, and it passed into history with credit to itself and to the nation. For two arduous and anxious years it served the country faithfully. The greatest tax laws and bond issues ever attempted by any nation form part of its record. It appropriated approximately sixty billion dollars and created agencies to control transportation, communication, food, fuel, finance and shipping. Stupendous was its record of accomplishment during the war, despite the controversies which beset it toward the end of its career. For these accomplishments it deserves the thanks of the American people. Our only regret is that it did not make its career more resplendent by passing the water-power

bill and by making an honest and diligent attempt to grapple with the reconstruction problems confronting the nation.

The electrical industry need not be discouraged, however, for had time not fought against it the water-power bill would have become law. Enough votes were pledged in the Senate to pass the measure, which had already been favorably acted on by the House of Representatives, but the eleventh-hour filibuster in the Senate which killed the effort against daylight saving also prevented a vote on the water-power bill. Thus the bill died. But there is every assurance that the water-power bill will be reintroduced in the next Congress and speedily passed. The country needs water-power development, the people are determined to have it, and no legislature wishes to withstand the will of the American people.

Now is no time to waste capital by plunging recklessly into uncertain developments, but let us remember that both waste and uncertainty are relative terms. Where an enterprise bids fair to realize a surplus above cost, let us break away from the idea that the maximum possible profit determines the launching of the undertaking.

Radio Direction-Finding Apparatus

A REMARKABLE and characteristic property of a simple, straight, vertical-mast antenna is that it is entirely devoid of directive action in the emission of signals and likewise entirely devoid of directive indication in the reception of signals. Because it stands straight upright, it sends out electromagnetic waves with equal impartiality to all points of the compass, and likewise signals coming from various quarters are all treated with the calm impartiality of blind-eyed justice, so that there is no means of ascertaining whence they come or whither they go.

As soon as the antenna abandons its simple vertical symmetry of structure and inclines more to one direction than to another it begins to exert selective properties with respect to that direction, both in sending and in receiving. Finally, if the antenna takes the form of a closed loop standing in one and the same vertical plane, the wave it tends to emit will have maximum intensity in that plane and zero intensity in the transverse direction. In the same manner, it will give maximum attention to incoming signals advancing in its plane and will be electrically deaf to signals that come in exactly transverse. Such a transverse wave would strike all four sides of the loop simultaneously, and the emfs. thereby generated in the sides would annul each other and cancel.

By taking a simple vertical loop or set of loops and rotating it about a vertical central axis, it thus becomes theoretically possible to orient any particular set of incoming electromagnetic waves to which the loop is attuned.

It may surprise some of our readers to learn from Capt. A. S. Blatterman's article in this number that a simple vertical frame of about 2.7 sq.m. area and containing in, say, twenty-five turns an aggregate area of 67.5 sq.m. will enable a radio observer, when equipped with suitable receiving apparatus, to hear on the eastern coast of America the high-power radio stations of Europe. Within certain limits of precision the true bearings of these stations may also be determined with such a frame. However, the distance of these European stations is so great from an observer situated, say, in New Jersey that their bearings are nearly all alike. On the other hand, the bearings of various high-power American stations will be correspondingly widened out to an American observer.

Two saliently valuable applications of the gonio-loop direction finder in peace times are to the establishment of the map position in bad weather of aircraft and of seacraft. It should ultimately become almost impossible for a careful navigator to lose his map position, either in the air or on the sea, if equipped with a good radio direction finder and with beacon stations at work in the neighborhood.

The simple loop, as described in Captain Blatterman's interesting article, is a direction finder and no more. That is to say, a simple vertical loop would be incapable of indicating whether the incoming signals arrived from, say, the northeast or the southwest. By the use of a pancake loop, however, the Signal Corps has utilized the dissymmetry of structure with respect to the inner and outer ends in such a way that the apparatus becomes a radio compass, or can show whether the signals are coming from the northeast or from the northwest. In many cases, of course, with well-known power stations, it becomes superfluous to inquire on which side their signals come in if their direction is known. In particular cases, however, the ambiguity of indication might be embarrassing.

A great deal of good may be accomplished just now by doing work at a modest rate of return in preference to standing idly and fearfully on the brink of enterprises which the country sorely needs in order to go forward to stable prosperity.

The Economy of Duplicate Lines

THERE have been many discussions of the most economical size of line wire for use under various conditions as regards the cost of copper, cost of construction and cost of energy. The factors entering into the problem when definite values can be assigned to them lead to formulas which with reasonable precision give the required answer. The fault of all such computations is that the factors assumed to be constant in the formulas vary from time to time in the most annoying manner, so that a line correctly laid out on a certain date may seriously violate the conditions of economy a few years later. The real solution of the problem requires therefore the eye of the prophet as well as the skill of the engineer. In our current issue P. O. Reyneau, who has already contributed valuable suggestions concerning distribution, takes up a practical phase of the matter which is somewhat out of the ordinary.

The question he raises concerns the relative economy of using one or two circuits for such service as feeders of large capacity, assuming that a certain maximum size of single conductor, in this case taken as No. 4/0, is not to be exceeded. Granted this, it is clear that

with increasing load a point will be reached where the energy loss over a single line will more than counterbalance the investment required for two lines. Mr. Reyneau's previous careful studies of the general economics of feeders and the probable increased distribution of load give him special facility for attacking a problem of this kind, and our readers will be interested in his form of computation to serve the purpose in hand. In the long run he so simplifies the working method as to reduce the tangible variables to a rather simple pair, the maximum load in amperes and the ratio of the cost of copper to the cost of energy. These can be estimated with at least an approximation to the truth from data at hand in any well-organized central station, and consequently a closely approximate solution of the whole problem can be reached. Perhaps the most interesting conclusion brought out by Mr. Reyneau's investigation is that under ordinary conditions of central-station use the economical loading of power wires is much below their reputed safe carrying capacity, and often very much lower than the general conditions would at first sight suggest. In other words, as a general rule a liberal investment in copper is in the long run a good policy. As a corollary to this proposition one may add that with the information here placed at our disposal it is a comparatively easy matter to find the maximum economical load for any given system of feeders. Knowing this, it is clearly good endeavor to secure intensive service on existing lines up to this point.

If Edison had struck for an eight-hour day, what would have been his percentage of achievement in scientific investigation? Clock watching may be necessary in train dispatching, but in constructive thinking it is an absurdity to cramp mental activity within narrow time limits.

Discrepancies in Power Interchange Prices

THE publication of contract prices for energy interchanged between adjacent utilities is a feature of commission work which sometimes leads the public to erroneous conclusions regarding the relations between buyer and seller. The layman, for example, finds it hard to understand why one central station should not buy electricity from another at the price at which it sells it on its own account to the other utility concerned, and it is important to explain the reasons for marked differences where such are brought forward in hearings or other public proceedings. Take the case of an actual contract where one company within a few miles of another buys energy at 1¾ cents per kilowatt-hour and sells it at ¼ cent to the same concern. The companies involved have each hydroelectric plants, steam auxiliary equipment and transmission lines interconnected for the interchange of energy under the most favorable circumstances. Despite the fact that the hydroelectric stations are all located on the same river or its immediate tributaries within a very few miles of one another and that the load centers of the two systems are certainly not more than 20 miles (32 km.) apart, it is apparent after a very short investigation that the costs of delivering energy by one company to the other may vary materially. One company serves a large manufacturing district, with important textile and shoemaking plants; the other supplies a residential and mercantile city which happens to be the state capital. When the latter utility needs additional energy it buys in preference to starting its own relatively inefficient auxiliary steam plant and paying a still higher price per unit of energy secured. The other company, on the other hand, seldom buys unless a measure of surplus output is available in the other system. The plant designs are naturally different, the loads vary considerably, and the system geography is diversified.

The real test of a fair price is regarded by each company as one which will save it money in the delivery of electricity to its customers, and the fact that the intercompany price is virtually three times in one case what it is in the other is without meaning from the standpoint of equitable intercorporate relationships.

Real interest in the immediate task and some appreciation of the well-nigh infinite possibilities that border the problems of our wonderful industry are more necessary to the common welfare of thoughtful workers in electricity than speculation as to the best methods of obtaining more pay for less work.

The Poor Coal Question

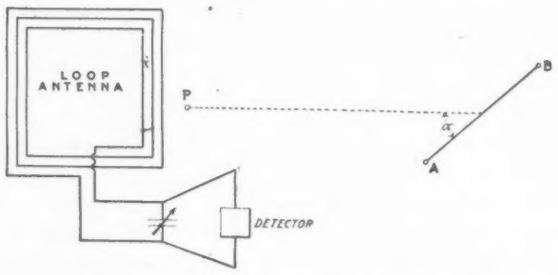
THE same necessity that requires the utmost diligence in improving station operation conditions makes attention to fuel and furnaces of much importance. One of the points about burning all poor coals, and some good ones, particularly if smokeless combustion is desired, is to allow a very ample furnace space for the ignition and the proper combustion of the fuel and its gaseous products. Besides this, the grate areas must be big, on account of the relatively low calorific value of the fuel. In other words, the furnace, as contradistinguished from the boiler itself, must be unusually large in order to consume low-grade fuel at a fair degree of efficiency. Long, high-pitched igniting arches are recommended with a grate area having a ratio to heating surface of not less than one to forty and a volume of furnace space of not less than 12 cubic feet per square foot of grate. Even this large allowance can often be advantageously increased, while the older furnaces show often less than half the figure just given for volume. It is therefore something of a task to reequip boilers originally planned for high-grade fuel so as to deal successfully with real low-grade coals. The stokers which are fitted for using the old fuel must very often be changed to handle the new without undue trouble from clinkers, and above all the furnace space needs to be increased to a very considerable degree. In many instances there is hesitancy about going to the trouble and expense of making the necessary changes. In the long run, however, the plant manager must make up his mind to the use of grades of coal somewhat lower than has been his practice. Sufficient results have now been obtained from low-grade fuel burned under proper conditions to give a very good line on what performance may be expected, and it is the part of wisdom to investigate the conditions of fuel supply thoroughly so that when a judgment can finally be formed as to the most desirable grade of fuel to use suitable equipment for burning that particular grade can be promptly procured.

Radio Direction-Finding Apparatus

Airplane Flight May Be Guided at Night or in Bad Weather by the Use of Direction-Finding Devices—Sources from Which Radio Signals Emanate Are Located by the Use of Movable Coils and Detector

BY CAPT. A. S. BLATTERMAN, SIGNAL CORPS, U. S. A.

THERE are two important uses of direction-finding apparatus. A listening station on the ground intercepts enemy radio communications and determines by radio measurements their origin. This is known as ground goniometry. Again, a listening station on a flying machine determines by radio measurements the direction of a fixed ground transmitting station or of several such ground stations. Through the bearings thus obtained the airplane pilot is able to steer a course accurately to his home station or to navigate his ship by radio in a manner entirely analogous to methods involving the readings of a magnetic compass, and thus avoid the possibility of getting lost in fogs or darkness.



FIGS. 1 AND 2—COMMON ARRANGEMENT OF LOOP RECEIVER AND DETECTOR; TOP VIEW OF LOOP RECEIVING WAVES FROM SOURCE AT *P*

The requirements of apparatus for these two kinds of service are essentially similar in their fundamental aspects. The directional settings must be capable of being made quickly and with a high degree of accuracy. The antenna must be small, because in the one case of the necessarily restricted space available on an airplane, and in the other—that is, the ground set—because of the requirements of low visibility, portability and general mechanical wieldiness. Very careful electrical design is necessary to secure the over-all high efficiency and strength of signal required of apparatus using small aërials and operated in the midst of noisy surroundings.

The ability to focus or project electromagnetic wave energy in a given predetermined direction or to exclude the reception of such energy from undesired sources, such, for instance, as may be easily accomplished in optics, has been studied for years. None of the devices based on these principles was successful in practical application to the problem of locating the direction of a transmitting station from a receiving station or to that of establishing, by radio, from a distance the exact location of a transmitter, and it was not until the observation had been made that the reception quality (as well as the radiation) of a vertical loop or closed antenna was not symmetrical, and that such a loop, if properly designed, could be effectively used in place of the usual antenna and ground connection, that practical direction-finding apparatus came into existence.

USE OF THE LOOP ANTENNA

The loop, as it is commonly used for directional receiving and as developed for military use in the present emergency, consists of a vertical closed coil of several turns of wire which can be tuned to incoming waves by means of a variable condenser connected across its terminals. A detector is connected either directly or inductively to the oscillating circuit so formed, the most common arrangement being that shown in Fig. 1. Such a system, when properly designed and used in connection with a sensitive multi-stage vacuum-tube amplifier detector device, may be effectively employed for receiving radio signals over very long distances. For instance, it is easily possible to hear the high-power stations of Europe in this country using a loop frame 5 ft. or 6 ft. (1.5 m. or 1.8 m.) square with twenty or thirty turns of wire on it.

The use of this type of antenna as an apparatus for locating the direction of a transmitting station depends on the fact that a vertically placed coil such as that described receives electromagnetic wave energy best when its plane coincides with the direction from which the waves are arriving, and practically not at all when placed at right angles to the direction of wave travel. Thus, in the practical use of the apparatus it is only necessary to be able to orient the loop about a vertical

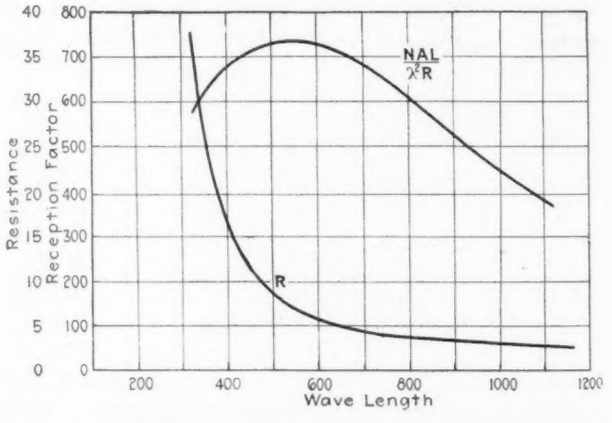
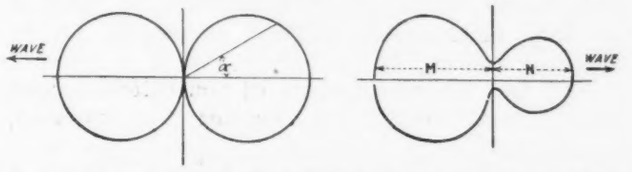


FIG. 3—VARIATION OF RESISTANCE AND RECEPTION FACTOR OF LOOP WITH WAVE LENGTH

axis, noting the strength of signals at different settings, in order to locate the direction of the origin or source of any radio that may be picked up. If two receivers equipped with this kind of apparatus are set up a known distance apart and both determine from their respective locations the direction of a certain transmitting station with respect to the geographic north

and south meridian, it becomes a simple matter of triangulation on the known base line joining the receivers to fix definitely the exact position of the transmitter.

The direction-finder problem of the Air Service involves additional considerations. In an airship in flight



FIGS. 4 AND 5—THEORETICAL DIRECTIONAL CHARACTERISTIC OF LOOP RECEIVER; ACTUAL DIRECTIONAL CHARACTERISTIC OF LOOP OBTAINED IN PRACTICE

the magnetic compass is not accurate. For instance, it is quite impossible to allow for drift in steering by the compass unless observations can be made by eye from the air of known landmarks or the location otherwise determined, as, for instance, by solar observations with suitable instruments, as is done on ships at sea. As a consequence of this the aërial navigator easily becomes lost at night or above the clouds and in fogs. A means was desired whereby a long-distance bombing airplane could go out after nightfall into enemy territory, drop its bombs, and be able to return accurately to its home station after completing its mission. The airplane radio direction finder has supplied this want in a remarkably satisfactory way, and has even been applied to the broader use of general aërial navigation by radio, so that it has become possible to fly any desired circuitous course simply by taking successive radio bearings on different ground transmitting stations and making calculations similar to those made by mariners at sea.

General Principles Affecting Design of Receiving Loops

In order to get the best results from the loop receiver it is necessary to proportion the size of loop properly, the number of turns, their spacing, the size and kind of wire, etc., to the wave lengths to be employed. The Signal Corps has worked out charts from which it is possible to design these coils quickly for any desired wave length so as to get maximum receiving efficiency.

The effective value of emf. induced in a coil or loop of wire of N turns and threaded by a harmonic flux Φ, such as produced by sustained oscillations in a distant radio antenna, $E = \sqrt{2}\pi fNAH$, where f = frequency, A = area inclosed by loop, H = field intensity.

If the loop is tuned to the frequency of the field in which it is placed by means of a condenser across its terminals, the impedance of the circuit so formed becomes equal to the resistance of the circuit and the r.m.s. current flowing will be

$$I = \sqrt{2}fNAH\pi/R.$$

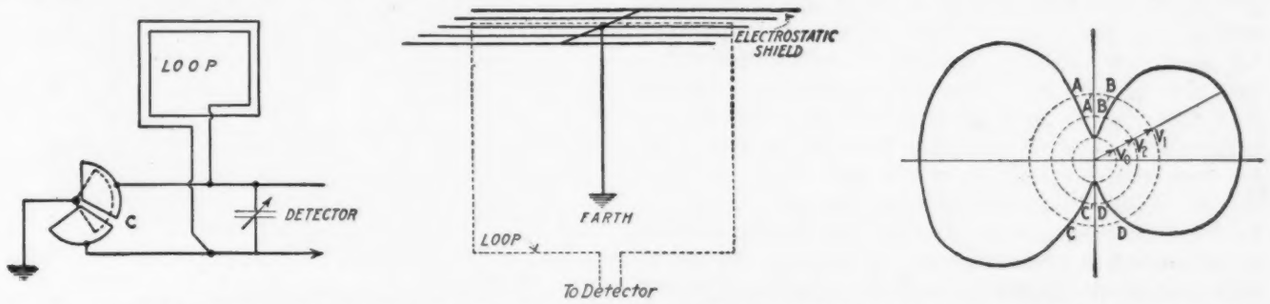
This current produces a voltage across the tuning condenser which is used to actuate the detector of the radio receiving set (see Fig. 1). The value of this voltage is given by the expression $E_c = kNAL/\lambda^2R$, where k = a constant, L = inductance of loop, λ = wave length, R = effective resistance of loop circuit.

A casual inspection of this formula indicates an advantage in the use of large area, many turns, high inductance and small tuning condenser for given wave length. Apparently also short wave lengths would be expected to give the loudest signals, and the resistance should always be kept low. Upon closer investigation, however, it is found that none of the factors N, A, L or λ can be varied without materially affecting the value of R, and most important of all is the very marked effect of changing wave length on the effective resistance. In fact, this circumstance gives rise to the existence of a critical optimum wave length for any given loop at which signals have their maximum strength, as indicated in Fig. 3.

The Directional Characteristic

As has been stated above, the loop antenna has very pronounced directional characteristics. If AB (Fig. 2) represents the top view of the loop which is receiving waves sent out from P, the flux threading the loop is proportional to cos α. Hence the received current will vary for different angular displacements in a manner which can be represented by a polar curve characteristic consisting of two tangent circles (Fig. 4). This would indicate that when the plane of the loop is at right angles to the direction of propagation no energy will be received, while strongest signals will occur when the plane of the loop coincides with the direction of wave travel. For direction finding the loop would be oriented until no sound was heard in the receiving telephones. Theoretically, a very accurate setting could be made owing to the great sensibility of the polar curves near the point of tangency, but in practice conditions are found to be less favorable, and conclusions based on the general theory must be somewhat modified.

In general, the polar curves are not circles but are



FIGS. 6, 7 AND 8—CONDENSER COMPENSATOR FOR IMPROVING DIRECTIONAL ACCURACY OF LOOP; ARRANGEMENT OF ELECTROSTATIC SHIELD ABOVE LOOP; EFFECT OF DETECTOR SENSITIVENESS ON DIRECTIONAL ACCURACY

changed according to the shape and dimensions of the loop, the manner of winding, proximity to the earth's surface or nearby conductors, the nature of the ground and the arrangement and disposition of the receiving apparatus. Thus a typical characteristic obtained by measurement of received signal at different angular

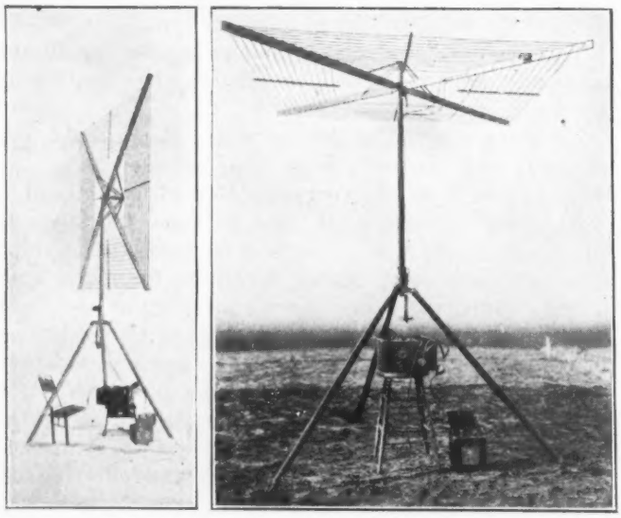


FIG. 9—DIRECTION-FINDING POSITION OF LOOP (LEFT) AND "INTERCEPT" POSITION (RIGHT)

positions of the loop is similar to that shown in Fig. 5. It will be noted that the two maxima and the two minima are unequal and the curve is distorted. Investigation of this distortion effect led to the development of methods for controlling it, either increasing it principally to augment the asymmetry of the maxima and thus secure a device which would indicate not only the line of the transmitting station but its sense or absolute direction, or else decreasing the dissymmetry in such a way that a very sharp minimum is decured and thus gain directional accuracy.

There are several ways of increasing the sharpness and symmetry of the minima of the polar curve. The solenoidal type of winding is better in this respect than the flat pancake loop. A small condenser *C* (Fig. 6) by means of which the capacity to earth of the two loop terminals may be equalized is helpful. Another method is to use an electrostatic shield consisting of a harp of parallel wires placed horizontally just above the loop and grounded (see Fig. 7).

Flat pancake loops with unequal maxima and minima have been used by the Signal Corps for finding absolute direction, since after finding the line by means of right-angle settings as usual it is only necessary to swing the loop into the position for maximum signals and compare the strengths *M* and *N* (Fig. 5) by reversing the loop through 180 deg. or by interchanging the connections to the tuning condenser by means of a switch.

When a loop is placed with its winding plane parallel to earth it becomes non-directional and receives signals equally well from all directions. This arrangement is therefore valuable for intercept work.

Effect of Receiver Sensitiveness.—The accuracy of the direction finder and the speed with which settings can be made depend on the sharpness of the minimum points in the directional polar characteristic. Some of the factors that effect this have just been discussed, but there is in addition to these another very important one, namely, the sensitiveness of the detecting apparatus.

If the sensitiveness is made very great, it is often difficult to find an absolute zero as the loop is rotated. Nevertheless, it is generally desirable to have the detection sensitiveness as great as possible for the following reason. If the polar curve is as shown in Fig. 8 and the sensitiveness of the detecting apparatus is such that it just responds to potentials of value V_1 and voltages less than this cannot be detected, then as the loop is rotated zero response will be obtained throughout the regions *AB* and *CD*. If, however, the detector sensitiveness is greater so that smaller voltages down to the value V_2 can be detected, the zero regions are narrowed down to *A'B'* and *C'D'* and the apparatus becomes more accurate. By further increasing the sensitiveness still greater accuracy is obtained as the zero regions are further narrowed, and, in the case shown, an increase in sensitiveness to correspond to the potential V_0 would give a single point or position where there would be zero response.

It is very desirable to produce this condition, but to do so requires extremely sensitive detecting apparatus as well as a very sharp antenna (loop) characteristic. If the zero regions are wider than a few degrees so that they cannot be accurately and quickly bisected experimentally, the average of the four readings *A*, *B*, *C*, *D*, where the signal becomes inaudible, must be taken as an indication of the true minimum. This requires time. It has, however, been found to give good accuracy provided the regions of silence do not exceed about 30 deg.

With the uncompensated loop the midpoints of the regions *AB* and *CD* are not 180 deg. apart, which

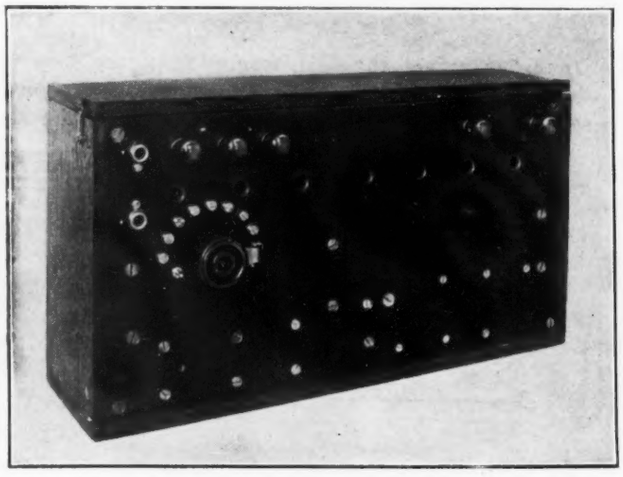


FIG. 10—ARRANGEMENT OF SEVEN VACUUM TUBES FOR AMPLIFYING PURPOSES

makes it necessary to average all four readings as just described. The electrostatic shield effectively removes this dissymmetry.

DEVELOPMENT OF AMPLIFIER

On account of the exponential relation between current passed and applied potential all the usual radio detectors respond much more effectively to large im-

pressed voltages—that is, strong signals—than they do to weak ones. In order to get the desired sensitiveness, therefore, it is necessary to amplify the radio-frequency energy in the receiving antenna loop system before passing it to the detector. This requirement has led to the development and use of radio-frequency vacuum-tube amplifiers.

The problem of building vacuum-tube amplifiers for radio frequencies is not essentially different from that where audio frequencies are involved. Fig. 10 shows a photograph of one of these instruments. The Signal Corps VT-1 vacuum tube is used.

The coupling between both the radio and audio frequency stages is provided by iron-core transformers whose impedances are adjusted to match the internal output tube impedance and whose turn ratios are approximately one to ten.

Direction Finders

Several different types of direction finders have been built by the Signal Corps. One has already been shown in Fig. 9. In working out a small portable outfit for field use the size was limited to 5 ft. (1.5 m.) on a side in order to meet the requirement of portability. The stipulated wave-length range was 300 m. to 800 m.

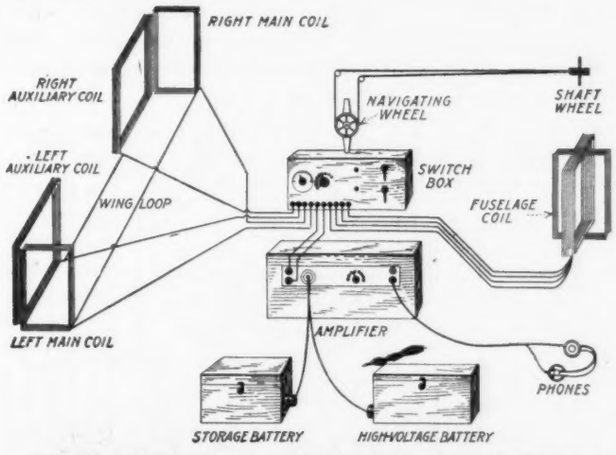


FIG. 11—ASSEMBLY OF AIRPLANE DIRECTION-FINDING SET

Extreme directional sensitiveness was required, together with the highest efficiency obtainable, in order to permit setting up as far as possible back from the battle front and shelled areas.

The equipment furnished comprises a vertical collapsible loop surmounted by an electrostatic shield consisting of a harp of wires 5 ft. long by 2 ft. wide (1.5 m. by 0.6 m.). The loop itself contains five turns of No. 18 wire sewed in a canvas strip. A collapsible table, measuring 5 ft. by 3 ft. (1.5 m. by 0.9 m.) on top and approximately 30 in. (0.75 m.) high, is furnished and supports the loop and its shield. Electrical connections to the loop are permanently made with the necessary lead wires fastened to the table top. A wheel with shaft and gear arrangement is provided and permanently fixed to the table for rotating the loop, and the whole structure folds together, forming a comparatively flat package for transit. A multi-stage combination radio-frequency and audio-frequency amplifier similar to that described above is used.

The requirements for airplane use of direction-finding radio apparatus are rather different from those for use on the ground. As has been explained, apparatus for ground direction-finding utilizes setting on a minimum or zero signal, but in an airplane the noise of the engine and rush of air drown out all save the very strongest radio signals and the ordinary direction finder methods are therefore of no use at all. Setting must be made "on the signal" rather than on the zero. This involves the use of a new method, credit for the application of which is due the British. The method used allows setting to the required direction with maximum strength of signal, while at the same time it retains the directional sensitiveness.

The apparatus is designed for use on the large Handley-Page bombing planes. High-power land stations send out prearranged signals and thus serve as beacons or radio lighthouses for the airplane, which is able to steer a course by radio in a manner quite analogous to navigation with the magnetic compass.

Two distinct sets of loops are provided. One is mounted rigidly on the struts and wings of the plane, a main coil fore and aft and an auxiliary coil athwartships. These coils have their turns sewed into a canvas band or strip about 6 in. (15 cm.) wide which is cemented on to the struts and the entering edges of the planes. They are used for straight homing flying. Another smaller set, about 3 ft. (0.9 m.) square, is mounted inside the fuselage of the airplane and arranged so that it can be rotated about a vertical axis by the navigator by means of a disk, cords and pulley device. By means of this second set of coils and a graduated dial the line of one of the beacon stations can be set, and if two such readings are taken quickly on different beacon stations the location of the plane may be determined. When the fixed wing coils are used it is necessary to alter the course of the ship in order to make the direction setting. The accuracy obtainable is about plus or minus one degree in making the radio setting. The general arrangement of the apparatus is shown in Fig. 11.

Peace-Time Use of the Radio Goniometer

While the war has given great impetus to study of the radio direction finder and has without doubt been responsible for development of apparatus that in the ordinary course of events during peace times would not have appeared for several years to come, yet it has required the direction of effort entirely along lines that were narrowed by military requirements and which led only to the two developments that have been described above. The principles worked out, however, relating to the design of this type of apparatus and the methods evolved for their application will without doubt find application in the near future to numerous other fields. Already ships at sea have been equipped with directional apparatus, and the Post Office Department at Washington has now begun investigating the question of using direction-finding radio compasses on planes in the aerial mail service. With a set of direction-finding loops on the plane and a ground transmitting station sending prearranged signals from the landing fields of each of the designated stopping places, the pilot could venture forth at practically any time with the assurance that prompt arrival at his destination would depend only upon the performance of his motor and the mechanical soundness of his ship.

Electrical Competition in Foreign Markets

An Exposition of the Manner in Which the Allgemeine Elektrizitaets-Gesellschaft of Berlin Has Dominated the World—How the Industry of the United States May Compete Successfully with This Powerful Organization

BY DR. JOSEPH M. GOLDSTEIN
Professor of Political Economy at the Moscow High Institute of Commerce and Industry and of the University of Moscow

LONG before the war the electrical industry of Germany, having brought to a very low factor the foreign competition in German markets, began to play an important rôle in the world's trade. In this respect it suffices to give the following data from German official statistics on Germany's foreign trade in some important electrical articles during the five-year period before the war:

Year	Electrical Appliances for Light and Power Transmission, Marks	Electrical Machinery, Marks	Incandescent Lamps, Marks
1909	20,600,000	30,200,000	36,400,000
1910	28,400,000	38,700,000	49,500,000
1911	32,300,000	47,000,000	45,800,000
1912	42,300,000	51,300,000	50,400,000
1913	74,000,000	56,500,000	48,100,000

From 1909 to 1913 the exports of above-mentioned goods increased from 87,200,000 marks to 178,600,000 marks[1], while the total imports amounted in 1913 to the unimportant sum of only about 7,000,000 marks[2].

The exports of all kinds of electrical products from Germany were directed to the European countries as well as to other parts of the world, and special attention was paid to the Russian market, which was by a reputed agreement or understanding between the Allgemeine Elektrizitäts-Gesellschaft of Berlin and the General Electric Company of America completely turned over to the above-mentioned German concern.

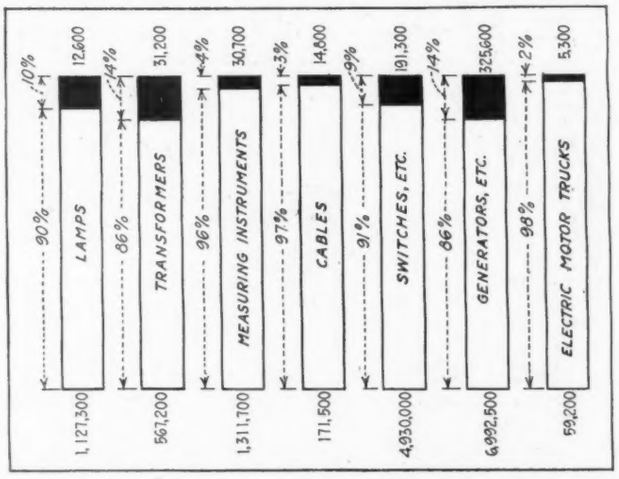
To show clearly the importance of the Russian market for American capital, investment and exports, it may be stated that Russia has many millions of horsepower in her streams and waterfalls which are awaiting exploitation. Taking into consideration that the construction of electrical power stations demands an average, including dynamos, cables, etc., of about $100 to $120 per horsepower, the electrification of Russia's water resources would demand in the next five or ten years an expenditure of at least $500,000,000 for machinery, cables, lamps and other electric supplies.

In what manner Germany understood long before the war the importance of Russia from that point of view is sufficiently shown by her rôle in Russian imports of electrical products, as it can be seen from the diagram on this page.

In this diagram the white part of the columns represents Germany's imports to Russia, while the black portion shows the imports from all other countries of the world. German imports of electrical apparatus and appliances into Russia amounted from 86 to 96 per cent of the total electrical imports of Russia, showing clearly to what extent Germany has had in Russia almost a complete monopoly.

The most influential factor of the electrical industry in Germany, as well as the most important in gaining the world's market for German products, has been the Allgemeine Elektrizitäts-Gesellschaft of Berlin, which by merciless competition and shrewd policy has compelled the electrical industry of the United States to enter into all kinds of disadvantageous agreements.

The war has destroyed all the old agreements, so disadvantageous for America, and the electrical industry of the United States, which has vastly developed its resources during the period of the war, will have to work assiduously for the world's market in order to find a suitable field for the application of American labor and accumulated capital.



IMPORTS OF ELECTRICAL PRODUCTS INTO RUSSIA IN THE YEARS 1912 AND 1913 (AVERAGE FOR TWO YEARS)[3]

In order to solve this problem properly the American electrical industry must, in the first place, be backed by American capital, inasmuch as without the most generous aid of the latter it will hardly be possible to compete with the Allgemeine Elektrizitäts-Gesellschaft, which, like a monster octopus with thousands of tentacles, has encircled the whole universe and, assisted by the powerful German banks and in alliance with two or three other electric concerns more or less closely united with these banks, has created a monopoly which permits to it the exploitation, with very few exceptions, of all the nations of the globe.

[1] About $42,000,000.

[2] It is not possible to compare the data of German foreign trade statistics for separate articles with those of the United States. All that can be stated in that direction is that the value of exports of the above-mentioned three groups of articles only was in 1913 about one and a half times larger than the total value of exports of the products of electric industry from the United States of America.

[3] The numbers above the columns represent Russia's imports from all countries in poods (1 pood equals about 37 lb.). The percentage figures show the relation of the imports of each article obtained from Germany to the total imports. The numbers below the columns show the total value of the imports from Germany in rubles (1 ruble equals about 51 cents).

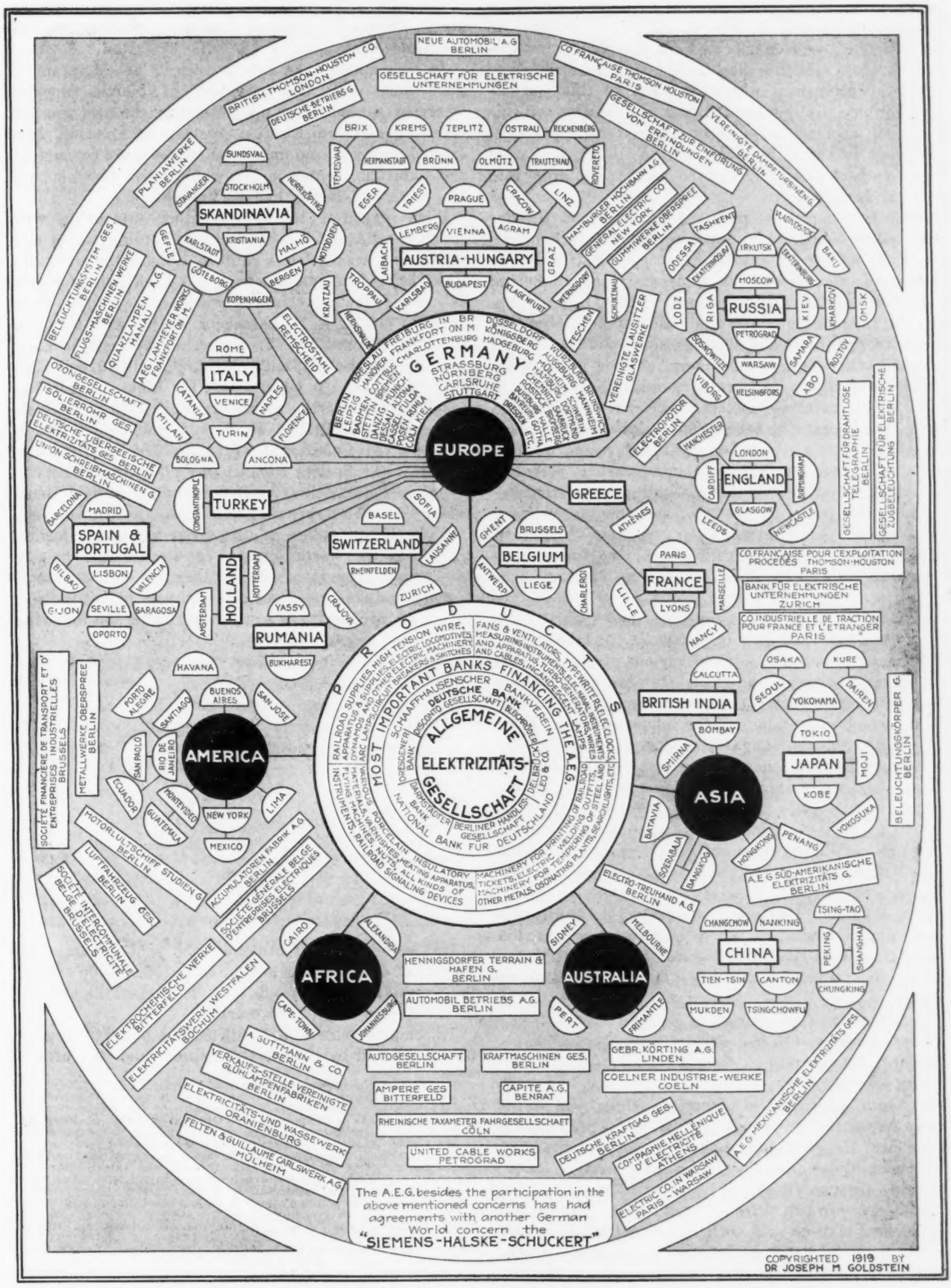

NEUE AUTOMOBIL A.G. BERLIN
GESELLSCHAFT FÜR ELEKTRISCHE UNTERNEHMUNGEN
BRITISH THOMSON-HOUSTON CO. LONDON
DEUTSCHE-BETRIEBS G. BERLIN
CO. FRANÇAISE THOMSON HOUSTON PARIS
GESELLSCHAFT ZUR EINFÜHRUNG VON ERFINDUNGEN BERLIN
VEREINIGTE DAMPFTURBINEN G.
EUROPE
GERMANY
AUSTRIA-HUNGARY
SKANDINAVIA
RUSSIA
ITALY
TURKEY
GREECE
ENGLAND
SPAIN & PORTUGAL
HOLLAND
SWITZERLAND
BELGIUM
FRANCE
RUMANIA
AMERICA
ASIA
AFRICA
AUSTRALIA
BRITISH INDIA
JAPAN
CHINA
PRODUCTS
MOST IMPORTANT BANKS FINANCING THE A.E.G.
ALLGEMEINE ELEKTRIZITÄTS-GESELLSCHAFT
DEUTSCHE BANK
DISCONTO GESELLSCHAFT
SCHAAFFHAUSENSCHER BANKVEREIN
DRESDNER BANK
DARMSTADTER BANK
NATIONAL BANK FÜR DEUTSCHLAND
BERLINER HANDELS GESELLSCHAFT
DEUTSCHE BANK (BERLIN, BREMEN, BRESLAU, COTTBUS, DANZIG, DESSAU, ESSEN, FREIBURG IN BR., FRANKFORT ON M., HANNOVER, KARLSRUHE, KASSEL, KIEL, KÖLN, KÖNIGSBERG, LEIPZIG, MADGEBURG, MANNHEIM, MÜLHEIM, MÜNCHEN, NÜRNBERG, POSEN, STETTIN, STRASSBURG, STUTTGART, WÜRZBURG)
RAILROAD SUPPLIES, HIGH TENSION WIRE, INSTRUMENTS, PLUGS, SWITCHES, PORCELAIN INSULATORY PARTS, RAILROAD SIGNALING DEVICES
FANS & VENTILATORS, TYPEWRITER, ELECTRIC CLOCKS, MEASURING INSTRUMENTS, ELECTRIC LOCOMOTIVES, AND APPARATUS, TURBO-GENERATORS, MOTORS, TRANSFORMERS, ARC LAMPS, CIRCUIT BREAKERS & SWITCHES, INCANDESCENT LAMPS, INSULATED WIRES AND CABLES, MACHINERY FOR PRINTING OF RAILROAD TICKETS, ELECTRIC MACHINERY FOR TEMPERING OF TEEL AND OTHER METALS, OSONATING PLANTS, SEARCHLIGHTS, ETC.
SKANDINAVIA: STOCKHOLM, KRISTIANIA, GÖTEBORG, KOPENHAGEN, MALMO, BERGEN, NORRKÖPING, NOTTODDEN, KARLSTADT, GEFLE, SUNDSVAL, STAVANGER
AUSTRIA-HUNGARY: BRIX, KREMS, TEPLITZ, OSTRAU, REICHENBERG, TEMESVAR, HERMANSTADT, BRÜNN, OLMÜTZ, TRAUTENAU, ROVERETO, EGER, TRIEST, PRAGUE, CRACOW, LINZ, LEMBERG, VIENNA, AGRAM, LAIBACH, TROPPAU, KARLSBAD, BUDAPEST, KLAGENFURT, WEINSDORF, GRAZ, SCHÖNEMAU, TESCHEN, KRATZAU, HERMANNMILS
GERMANY: BERLIN, BRESLAU, FREIBURG IN BR., LEIPZIG, BARMEN, STETTIN, DANZIG, DESSAU, CASSEL, POSEN, DÜSSELDORF, KÖNIGSBERG, MADGEBURG, HANNOVER, FRANKFORT ON M., CHARLOTTENBURG, BREMEN, MÜNCHEN, KÖLN, KIEL, KARLSRUHE, STUTTGART, NÜRNBERG, STRASSBURG, WÜRZBURG, BRUNSWICK, AUGSBURG, MÜLHEIM, CHEMNITZ, POSEN, KASSEL, DRESDEN, BAYREUTH, GOTHA, ETC.
RUSSIA: MOSCOW, PETROGRAD, WARSAW, HELSINGFORS, RIGA, LODZ, BOBNOWITZE, VIBORG, KIEV, KHARKOV, OMSK, SAMARA, ROSTOV, ABO, ODESSA, EKATERINOSLAV, IRKUTSK, TASHKENT, VLADIVOSTOK, BAKU, EKATERINBURG
ITALY: ROME, VENICE, TURIN, NAPLES, FLORENCE, ANCONA, BOLOGNA, MILAN, CATANIA
TURKEY: CONSTANTINOPLE
GREECE: ATHENES
ENGLAND: LONDON, MANCHESTER, CARDIFF, GLASGOW, LEEDS, NEWCASTLE, DURTINGHAM
SPAIN & PORTUGAL: MADRID, BARCELONA, LISBON, OPORTO, SEVILLE, SARAGOSA, VALENCIA, BILBAO, GIJON
HOLLAND: AMSTERDAM, ROTTERDAM
SWITZERLAND: BASEL, ZURICH, LAUSANNE, RHEINFELDEN
BELGIUM: BRUSSELS, GHENT, ANTWERP, LIEGE, CHARLEROI
FRANCE: PARIS, LYONS, MARSEILLE, NANCY, LILLE
RUMANIA: BUKHAREST, CRAJOVA, YASSY
AMERICA: HAVANA, BUENOS AIRES, SAN JOSE, PORTO ALEGRE, SANTIAGO, RIO DE JANEIRO, SAN PAOLO, ECUADOR, MONTEVIDEO, GUATEMALA, NEW YORK, LIMA, MEXICO
ASIA: BOMBAY, CALCUTTA, SMIRNA, BATAVIA, SOERABAJA, BANGKOK, HONGKONG, PENANG
BRITISH INDIA: BOMBAY, CALCUTTA
JAPAN: TOKIO, YOKOHAMA, OSAKA, KURE, SEOUL, DAIREN, MOJI, KOBE, YOKOSUKA
CHINA: NANKING, CHANGCHOW, TSING-TAO, PEKING, SHANGHAI, CHUNGKING, TIEN-TSIN, CANTON, MUKDEN, TSINGCHOWFU
AFRICA: CAIRO, ALEXANDRIA, CAPE-TOWN, JOHANNESBURG
AUSTRALIA: SIDNEY, MELBOURNE, PERT, FRIMANTLE
BELEUCHTUNGSSYSTEM GES. BERLIN
FLUGS-MASCHINEN WERKE BERLIN
QUARZLAMPEN A.G. HANAU
A.E.G. LAHMEYER WORKS FRANKFORT ON M.
PLANIAWERKE BERLIN
OZONGESELLSCHAFT BERLIN
SOLIERROHR GES. BERLIN
DEUTSCHE UBERSEEISCHE ELEKTRIZITÄTS GES. BERLIN
UNION SCHREIBMASCHINEN G. BERLIN
ELECTROSTAHL REMSCHEID
ELECTRO-MOTOR BERLIN
VEREINIGTE LAUSITZER GLASWERKE
GESELLSCHAFT FÜR DRAHTLOSE TELEGRAPHIE BERLIN
GESELLSCHAFT FÜR ELEKTRISCHE ZUGBELEUCHTUNG BERLIN
CO. FRANÇAISE POUR L'EXPLOITATION PROCEDES THOMSON-HOUSTON PARIS
BANK FÜR ELEKTRISCHE UNTERNEHMUNGEN ZURICH
CO. INDUSTRIELLE DE TRACTION POUR FRANCE ET L'ETRANGER PARIS
SOCIETÉ FINANCIERE DE TRANSPORT ET D'ENTREPRISES INDUSTRIELLES BRUSSELS
METALLWERKE OBERSPREE BERLIN
MOTORLUFTSCHIFF STUDIEN G. BERLIN
LUFTFAHRZEUG GES. BERLIN
ACCUMULATOREN FABRIK A.G. BERLIN
SOCIETÉ GÉNÉRALE BELGE D'ENTREPRISES ELECTRIQUES BRUSSELS
SOCIETÉ INTERCOMMUNALE BELGE D'ELECTRICITÉ BRUSSELS
ELEKTROCHEMISCHE WERKE BITTERFELD
ELEKTRICITÄTSWERK WESTFALEN BOCHUM
A. SUTTMANN & CO. BERLIN
VERKAUFS-STELLE VEREINIGTE GLÜHLAMPENFABRIKEN BERLIN
ELEKTRICITÄTS-UND WASSERWERK ORANIENBURG
FELTEN & GUILLAUME CARLSWERK A.G. MÜLHEIM
HENNIGSDORFER TERRAIN & HAFEN G. BERLIN
AUTOMOBIL BETRIEBS A.G. BERLIN
AUTOGESELLSCHAFT BERLIN
KRAFTMASCHINEN GES. BERLIN
AMPERE GES. BITTERFELD
CAPITE A.G. BENRAT
RHEINISCHE TAXAMETER FAHRGESELLSCHAFT CÖLN
UNITED CABLE WORKS PETROGRAD
GEBR. KÖRTING A.G. LINDEN
COELNER INDUSTRIE-WERKE COELN
ELECTRO-TREUHAND A.G. BERLIN
A.E.G. SÜD-AMERIKANISCHE ELEKTRIZITÄTS G. BERLIN
A.E.G. MEXIKANISCHE ELEKTRIZITÄTS GES. BERLIN
DEUTSCHE KRAFTGAS GES. BERLIN
COMPAGNIE HELLÉNIQUE D'ELECTRICITÉ ATHENS
ELECTRIC CO. IN WARSAW PARIS - WARSAW
BELEUCHTUNGSKÖRPER G. BERLIN
The A.E.G. besides the participation in the above mentioned concerns has had agreements with another German World concern the "SIEMENS-HALSKE-SCHUCKERT"
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CHART SHOWING HOW THE ALLGEMEINE ELEKTRIZITAETS-GESELLSCHAFT HAS DOMINATED THE WORLD'S ELECTRICAL BUSINESS TO THE EXCLUSION OF COMPETITORS

The writer has in his possession an interesting official document belonging to the "A. E. G." of Berlin. In this document are enumerated all the plants, installation bureaus, agencies, electrical stations, railroads and street-car companies which belonged to this German corporation. In the twelfth and last section of this document are mentioned fifty-nine enterprises which, according to the information of the "A. E. G.," were more or less closely associated or had entered into agreements with it.

From this official list prepared by the "A. E. G." one can readily see, first, that this company, which before the war controlled a capital of at least half a billion dollars, manufactured at its numerous plants in Berlin, Frankfort-on-Maine, Hennigsdorf, Vienna, Riga, Milan, etc., the following products: railroad supplies, high-tension wire, apparatus and supplies, small and large dynamos and other electric machinery, electric locomotives, arc lamps, supply materials, circuit breakers and switches, integrating meters, typewriters, fans and ventilators, measuring instruments, electric clocks, electric naval instruments and apparatus, turbo-generators, wires and cables, incandescent lamps, various porcelain insulatory materials, varnishes, heating apparatus, flying machines, nuts, all kinds of instruments, railroad signaling devices, machinery for printing of railroad tickets, electric welding outfits, machinery for tempering of steel and other metals, ozonating plants, searchlamps, etc.[4]

Second, this document shows that the "A. E. G.," irrespective of the fact that in almost all the large towns of Germany it had possession of various plants, installation bureaus, bureaus of sales, stations, etc. (in all, about 180 German towns), had also numerous branches in the commercial centers of the following countries:

Europe.—Austria-Hungary, in thirty cities; Italy, in ten cities; England, in seven cities; Spain, in seven cities; Belgium, in six cities; Sweden, in six cities; France, in five cities, Norway, in five cities; Switzerland, in four cities; Roumania, in three cities; Holland, in two cities; Portugal, in two cities; Denmark, in one city; Turkey (European), in one city; Greece, in one city.

Asia.—China (including Manchuria), in twelve cities; Japan (including Korea and Formosa), in ten cities; Singapore, one office; Java, two offices; India, in two cities; Siam, in one city; Turkey (Asiatic), in one city.

Australia.—In four cities.

North America.—In one city.

Mexico.—In one city.

Cuba.—In one city.

In South and Central America.—Brazil, in three cities; Argentina, in one city; Chile, in one city; Peru, in one city; Uruguay, in one city; Ecuador, in one city; Guatemala, in one city; Costa Rica, in one city.

Egypt.—In two cities.

Transvaal.—In two cities.

The same may be said with regard to Russia, where the "A. E. G." of Berlin maintained its branches, plants, installation bureaus, electrical stations, etc., in the following cities: Petrograd, Moscow, Riga, Kharkoff, Kieff, Odessa, Warsaw, Lodz, Sosnovitzi, Samara, Rostov-on-Don, Ekaterinoslav, Baku, Ekaterinburg, Irkutsk, Omsk, Vladivostok, Tashkent, Helsingfors, Viborg and Abo[5].

In this manner, as can be seen in the diagram on page 469, with the exception of North America, where by agreement or understanding the field was left free to the General Electric Company of America, there existed practically no important city or large commercial and industrial center in the whole world in which the "A. E. G." of Berlin had no branch.

With regard to the various other enterprises with which the "A. E. G." of Berlin, according to its own statements, was in close contact, besides the Bank für Elektrische Unternehmungen in Zürich (see footnote 5)[6], the following concerns must be especially mentioned: (1) A. E. G. Lahmeyer Werke, with a capital of 50,000,000 marks; (2) Deutsch-Ueberseeische Elektrizitäts-Gesellschaft, with a capital up till 1913 of 230,000,000 marks; (3) Gesellschaft für Elektrische Unternehmungen, in Berlin, with a capital in 1912 of 105,000,000 marks; (4) British Thomson-Houston Company, in London; (5) Compagnie Française Thomson-Houston, in Paris; (6) Société Financière de Transport et d'Enterprises Industrielles, in Brussels; (7) Société Générale Belge d'Enterprises Electriques, in Brussels, etc.

With the assistance of the above-named companies, the "A. E. G.," having created for itself a monopoly in innumerable countries, and irrespective of vast amortization and reserve funds, etc., had paid before the war very high dividends, as can be seen from the following data:

Year	Paid-up Capital[7] of the "A.E.G." Marks	Dividends, Per Cent.
1897–1898	25,000,000	15
1898–1899	47,000,000	15
1899–1900	47,000,000	15
1900–1901	60,000,000	12
1901–1902	60,000,000	8
1902–1903	60,000,000	8
1903–1904	82,500,000	9
1904–1905	86,000,000	10
1905–1906	93,000,000	11
1906–1907	100,000,000	12
1907–1908	100,000,000	12
1908–1909	100,000,000	13
1909–1910	100,000,000	14
1910–1911	100,000,000	14
1911–1912	130,000,000	14
1912–1913	155,000,000	14

Just before the war broke out the paid-up capital of the "A. E. G." of Berlin amounted to 155,000,000 marks, the reserve and other funds to 93,000,000 marks and the bond issues to 108,000,000 marks.

To compete successfully with such a powerful organization, backed by the most prominent and best organ-

[4]After the declaration of war this company was one of Germany's principal sources of military supplies.

[5]In addition to corporations with which the "A.E.G." of Berlin was closely associated, the following factories were established in Russia with her direct help: (1) a branch of the Berlin firm of A. Guttman; (2) a branch of the German concern of Koerting Brothers; (3) an electrical company in Warsaw; (4) the Associated Cable Works in Petrograd; (5) the so-called company of the year 1886, in Moscow. The last-mentioned organization was under the auspices of the "A.E.G." through the intermediary of the Bank für Elektrische Unternehmungen in Zürich, which, according to the official information of the "A.E.G.," was closely affiliated with that company but in reality was completely in its hands. In order to create for itself a lasting monopoly in the Russian market, the "A.E.G." eliminated all competition among the retail dealers, dividing Russia into separate districts. For instance, in placing orders, the retail dealers of north Russia were compelled to apply to Petrograd, the retail dealers of Moscow to the main branch of the "A.E.G." in Moscow, the retail dealers of Poland to the main branch of the "A.E.G." in Warsaw, etc. In view of the absence of competition, owing to the international agreements, the whole of Russia's market was in this manner under complete domination of the "A.E.G." •

[6]This bank helped the "A.E.G." to borrow money from Switzerland, France, Belgium and other countries.

[7]Not including companies under control of the "A.E.G."

ized banks in the world, such as the Deutsche Bank, Discontogesellschaft, Dresdner Bank, Darmstädter Bank, Schaafhausenscher Bankverein, National Bank für Deutschland, Berliner Handelsgesellschaft, Bleichröder, Delbrück, Leo & Company, etc., with a paid-up capital of over $300,000,000 reserve and other funds of about $120,000,000 and deposits of more than $1,250,000,000,* the American electrical industry must be backed by a consortium of the biggest banks in the United States.

Should the latter not back the American electric industry the old world domination of the "A. E. G." will return in greater force than before the war, and the tremendous work that the electrical industry of America has accomplished for the development of its exporting trade in increasing exports from $26,800,000 in 1913 to $51,900,000 in 1917 will be frustrated.

Determination of Economical Power Circuits

Method of Deriving Curves Showing When Two Circuits Become More Economical than One as Load Increases—Fixed Charges Are Balanced Against Saving of Line Loss When New Conductors Are Added

BY P. O. REYNEAU
Distribution Engineer the Detroit Edison Company

IN AN article previously published under the same title* it was shown how to determine the relative economies of the various sizes of wire used for three-phase power circuits when the cost of copper wire, the cost of energy at the point of loss, the equivalent hours during which the load is on the circuit and the maximum current are known. The equivalent hours are taken as meaning the time of maximum loading that would produce the same daily energy loss as the actual load does. The largest size of wire used was No. 4/0, and it was considered the largest size that could be installed on average pole lines without special reinforcements and devices. For reference, one of the curve sheets printed with the previous article (Fig. 1) is reproduced, showing the economical size of conductor for three-phase power circuits with any ratio between copper and energy cost when the equivalent hours equal 9.69.

DEDUCTIONS FROM CURVES IN FIG. 1

It is obvious from a study of these curves that a minimum load, under various conditions of the other variables involved, at which a No. 4/0 line is economical was shown. On the other hand, the other limit—that is, the maximum load that is economical under the same conditions—was not determined. In other words, the field beyond the line at which the economy changed from one No. 3/0 to one No. 4/0 line was not explored. It is here desired to point out the method of finding when it is economical to operate two circuits in the place of one and to draw some conclusions regarding the results obtained. As the load is increased it is evident that a point will be arrived at when the additional energy loss by using one line will be greater than the additional investment charge for using two lines.

Obviously any size of line with the same required spacing occupies the same amount of pole space, so that in the study referred to above it was not necessary to take into consideration the pole-space rental in order to get a comparison between various sizes of wire. On the other hand, if a second line is strung on the same poles as the first line, or strung by another route of approximately the same length, to carry a load that previously was handled by only one line, the pole space rental becomes chargeable to the second line and must be taken into account in the economics of the proposition.

To simplify matters here we have considered a simple case as an example—that is, taking one No. 4/0 line and two No. 4/0 lines. There could naturally be a number of possible combinations of two lines of the same size of wire or different sizes of wire. It has also been assumed here that the equivalent hours of loading are 9.69, which agrees with the first curve submitted. The equivalent hours chosen represent an average obtained from the study of actual conditions on a large number of power circuits and should be applicable to such circuits in many localities with a fair chance of accuracy.

DERIVATION OF EQUATIONS

If K_1 = the annual fixed charge per 1000 ft. of line,
K_2 = the annual charge on energy consumption per 1000 ft. of line,
k = multiplication factor,
D = distance of transmission in thousands of feet,
g = per cent interest and depreciation,
W = weight per foot of wire,
C_c = price of copper wire per pound,
H = cost of stringing 1000 ft. of line,
ρ = resistivity of wire in ohms per mil-foot,
A = area of wire in circular mils,
t = equivalent hours per day peak load is on,
C_e = cost of energy per kilowatt-hour,
C_{ins} = cost of insulators,
C_{ps} = cost of pole space,

we can proceed to formulate equations for K_1 and K_2.

K_1 = annual charge on copper + insulators + pole space + stringing per 1000 ft. of line.

*In these sums are not included the paid-up capital, reserve funds and deposits of smaller but often very important banking corporations controlled by the above-mentioned principal German banks. For instance, the Deutsche Bank controls the following banking corporations: Deutsch-Ueberseeische Bank, Deutsch Ostafricanische Bank, Deutsche Vereinsbank in Frankfort-on-Main, Essener Kredit-Anstalt, Hannoversche Bank, Mecklenburger Hypothek- und Wechselbank, Nieder-Lausitzer Bank, Oldenburger Spar- und Leihbank, Pfälzische Bank, Privatbank in Gotha, Rheinische Kreditbank, Schlesischer Bankverein, Württembergische Vereinsbank, Deutsche Treuhandels-Gesellschaft, Märkische Bank, etc.

*See ELECTRICAL WORLD, May 25, 1918, page 1072.

Considering spacing of 100 ft., then

$$K_1 = \frac{g}{100}(3000 \times W \times C_c + 30\,C_{ins} + 10C_{ps} + H).$$

Letting $k = 1 + \left(\frac{30\,C_{ins} + 10\,C_{ps} + H}{3000 \times W \times C_c}\right)$,

then $K_1 = \frac{g}{100}(k3000 \times W \times C_c)$.

K_2 = annual charge on energy consumption per 1000 ft. of line.

$$K_2 = I^2\frac{\rho}{A} \times 3000 \times t \times 300 \times \frac{C_e}{1000}$$

$$= 900\frac{\rho}{A}I^2 \times t \times C_e.$$

Having obtained expressions for K_1 and K_2, the next step is to determine the annual charges for a single line and for two lines.

Single line $= (K_1 + K_2)D$

$$= \left[\frac{g}{100}(k3000 \times W \times C_c) + 900\frac{\rho}{A}I^2 \times t \times C_e\right]D \quad (1)$$

Two lines $= (2K_1 + \tfrac{1}{2}K_2)D$

$$= \left[\frac{2g}{100}(k3000 \times W \times C_c) + 450\frac{\rho}{A}I^2 \times t \times C_e\right]D \quad (2)$$

(The investment is double, the load is half in each line, the energy loss quarter in each line, therefore the total energy loss is half that of a single line.)

When the annual charges (1) equal the annual charges (2), then it is as economical to use either a single or a double line.

Hence

$$\left[\frac{g}{100}(k3000 \times W \times C_c) + 900\frac{\rho}{A}I^2 \times t \times C_e\right]D$$
$$= \left[\frac{2g}{100}(k3000 \times W \times C_c) + 450\frac{\rho}{A}I^2 \times t \times C_e\right]D \quad (3)$$

Since C_e and C_c are not constant and I and t depend on the load, it is advisable in order to make the equation

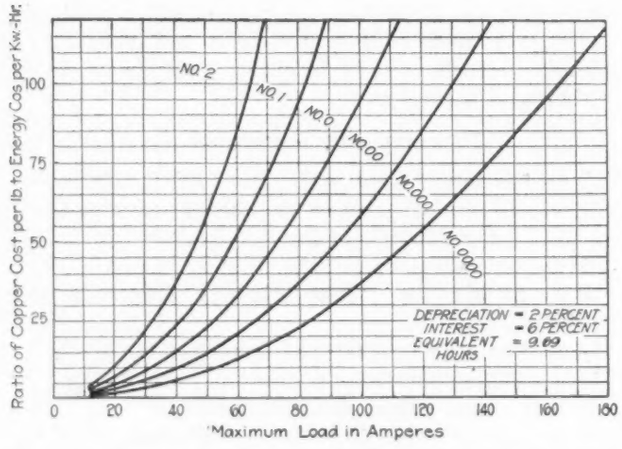


FIG. 1—ECONOMICAL SIZE OF WIRE FOR ANY RATIO OF COPPER COST TO ENERGY COST FOR THREE-PHASE POWER CIRCUITS

most usable to solve equation (3) for the ratio of C_c/C_e. This leaves these two variables in a convenient form for handling.

Therefore

$$30gkWC_c - 450I^2t(\rho/A) \times C_e = 0$$

and

$$\frac{C_c}{C_e} = \frac{450(\rho/A) \times I^2t}{30gkw} \quad (4)$$

Substituting in general equation (4),

ρ = 10.8 ohms per mil foot.

t = 9.69 equivalent hours per day peak load is on (see above-mentioned report).

g = 10 (6 per cent interest and 4 per cent depreciation).

W = 0.6405 lb.-ft. (using No. 4/0 wire).

A = 211,600 circ.mil (using No. 4/0 wire).

$$k = \frac{1 + 30C_{ins} + 10C_{ps} + H}{3000 \times W \times C_c}.$$

POLE-SPACE RENTAL

Fig. 2 shows how the pole-space rental was arrived at. A survey of the lines under consideration indicated that the conditions shown on the sketch represented

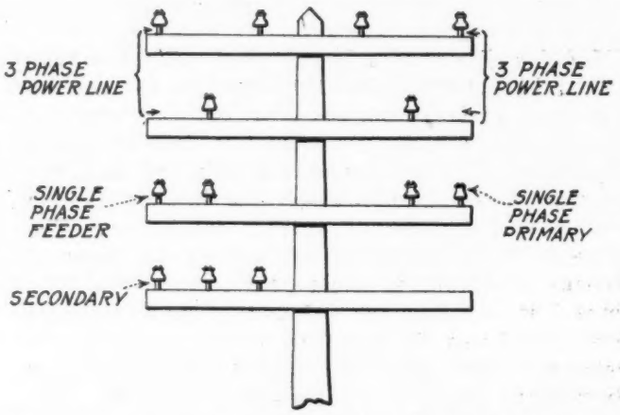


FIG. 2—ARRANGEMENT CONSIDERED IN FINDING POLE RENTAL

the average conditions on the pole lines carrying three-phase circuits. On the sketch there are four cross-arms used and twenty-four pins are possible. In a power circuit with standard 28-in. (71-cm.) spacing between wires and also with a minimum of 28 in. between these power wires and any other wires, it is necessary to charge the power circuit with six pin positions; in other words, the pole-space rental of one power circuit on the average pole line will be six-twenty-fourths, or one-quarter, of the cost of the pole plus the cost of the arms—both of these installed.

Using costs obtained as shown above we find that

$$k = 1 + \frac{30 \times 0.4949 + 10 \times 8.61 + 59.42}{3000 \times 0.6405 \times C_c} \quad (5)$$

$= 1 + (0.0832/C_c)$. Solving for k, using values of \$0.20, \$0.30 and \$0.40 for C_c, it is found that

$$k_{0.20} = 1 + 0.0832\ (1/0.20) = 1.416,$$
$$k_{0.30} = 1 + 0.0832\ (1/0.20) = 1.277,$$
$$k_{0.40} = 1 + 0.0832\ (1/0.20) = 1.208.$$

It should be noted here that in the derivation of the equation (4) the cost of insulators, pole space and stringing was carried through as a percentage of the copper costs as shown in equation (5) for k. This was found necessary in order to express this equation in the form above, giving it as the quotient of the two most important variables. This percentage is variable with the cost of copper, and its effect on curves is shown by drawing them for \$0.40, \$0.30 and \$0.20 copper.

It is now possible to put the actual values in general equation (4) and obtain the following:

$$C_c/C_e = 0.00082\,I^2 \quad (C_e = \$0.20),$$
$$C_c/C_e = 0.00091\,I^2 \quad (C_e = \$0.30),$$
$$C_c/C_e = 0.00096\,I^2 \quad (C_e = \$0.40).$$

DISCUSSION OF CURVES

Fig. 3 shows equation (4) plotted for three values of C_e ($0.20, $0.30 and $0.40) and also shows the equation determining the points at which a No. 3/0 and a No. 4/0 line are equally economical. This was reproduced from Fig. 1 as a means of comparison and for the sake of limiting the field of economy of a single No. 4/0 line both as to minimum current and as to maximum current.

The areas as indicated represent the conditions under which it would be most economical to use a single No. 3/0, single No. 4/0 line or two No. 4/0 lines.

The economical design is brought down to two tangible variables—the maximum load in amperes and the ratio of copper cost to energy cost per kilowatt-hour. It is therefore only necessary to substitute in the equation values that are in most cases quite easy to secure. It should be noted that the method of obtaining economical circuits is limited only by matters of regulation. In other words, having determined the length of the line, the available voltage at the station and the voltage desired at the receiver end, it must first be determined whether the voltage loss is not too great under the most economical design, thus making it necessary to increase the size of the line or provide some other means of getting satisfactory service.

Further, in many cases physical conditions and matter of right-of-way may come in to force alteration of the conditions prescribed by the curves as the most economical. In all cases, however, the curves can be

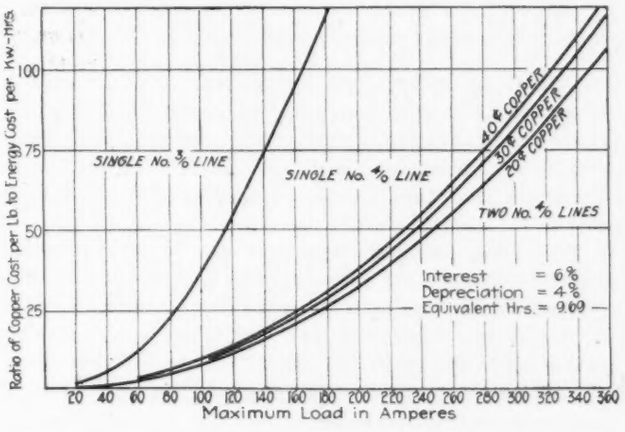

Ratio of Copper Cost per Lb. to Energy Cost per Kw-Hrs.
100
75
50
25
SINGLE No. 3/0 LINE
SINGLE No. 4/0 LINE
TWO No. 4/0 LINES
40¢ COPPER
30¢ COPPER
20¢ COPPER
Interest = 6%
Depreciation = 4%
Equivalent Hrs. = 9.69
20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Maximum Load in Amperes

FIG. 3—ECONOMICAL CIRCUITS FOR ANY RATIO OF COPPER COST TO ENERGY COST FOR THREE-PHASE POWER LINES

used as a guide and should be of service in obtaining the best design.

Finally, it should be pointed out that the various factors entering into the equation and substituted numerically to obtain the curves submitted represent approximately existing conditions and that other existing conditions at other places would probably not in most cases change the location of the curves to a great extent.

If such is the case, with equivalent hours of 9.69 representing a fair load factor and an average condition on industrial power circuits, it is quite apparent that the economical loading of power wire is considerably below the so-called safe carrying capacity of the wire, and at first sight, under certain conditions of the ordinate, surprisingly low.

INSURING PROTECTION OF CURRENT TRANSFORMERS

Series Resistors or Reactors and Shunt Resistors, Condensers or Vacuum Gaps Assist When Used Separately or in Combination

BY V. KARAPETOFF

ONE of the troubles with which operating companies are confronted is the burning out of current transformers connected to long cables or overhead lines. A frequent cause of such failure is a steep-front electric surge coming to the station from the line. The opening of a remote oil switch, a short circuit or flash-over somewhere on the line, a sudden change in the load—all such occurrences produce an instantaneous change in the electrical conditions and give rise to a surge. Such a surge upon entering a station or substation suddenly meets with a high concentrated inductance of a current transformer and is forced to undergo a partial reflection. This reflection is accompanied by a transformation of magnetic energy into electrostatic, and consequently the voltage at the transformer suddenly rises and sometimes exceeds the safe limit. The reflected surge may not be absorbed at the other end of the line and may return several times, giving repeated "blows" to the current transformer.

The phenomenon is somewhat similar to a water hammer in a water-supply system. A sudden closing of a valve causes an instantaneous local rise in pressure, and the pressure wave is propagated along the system, undergoing reflections at the closed end until the whole energy has been dissipated in friction and vibrations.

In many cases the electrical line itself and the generators are sufficiently well insulated to stand considerable overvoltages, but the series transformer is the weakest link in the chain. The problem is therefore a threefold one:

1. To flatten the steep wave front of the incoming surge so as to reduce the first shock against the transformer.

2. To absorb gradually the energy of the surge by converting it into heat.

3. To provide a by-pass shunt for the surge around the transformer, in order that the shock of overvoltage may be received by some other piece of apparatus more capable of withstanding it.

Some possible solutions may be briefly summarized as follows:

1. The wave front may be flattened by having small reactance coils along the line. A condenser connected across the line just ahead of the transformer absorbs part of the surge and relieves the transformer of the first shock. A spark gap or an electrolytic arrester

across the line accomplishes the same result, though less effectively on account of the time lag.

2. The energy of the surge may be gradually dissipated in resistances. Carborundum rods have been used for this purpose. A proper resistance shunted across the series transformer offers an easier path for the steep wave front than the highly inductive coil, and while the front end of the surge is passing through the resistance its energy is partly converted into heat.

3. If meters are connected to the series transformer, then the by-pass shunt must possess a very high or even infinite resistance under normal conditions, in order not to impair the accuracy of the ratio of transformation. At the same time the by-pass must break down readily and without an appreciable time lag.

The vacuum-gap arrester has been found very helpful for such protection, according to reports. It consists of a small closed copper tube from which the air has been exhausted and which is provided with a spark gap inside. A comparatively large gap in vacuo is equivalent to a small gap in the air, so that the device is well adapted for low potentials. When a considerable difference of potential is established across the transformer terminals owing to a surge, the gap is broken down and the surge passes through it. A resistance, such as a carborundum rod, in series with the gap, helps to absorb the energy of the surge and adds to the protective value of the spark gap. The successful use of such vacuum gaps has been reported by the Public Service Company of Northern Illinois and by the Georgia Railway & Power Company. An aluminum cell and a sphere gap have also been recommended as suitable shunts around a series transformer, and it would be of interest to investigate their value as such.

These three aspects of the problem offer a fruitful field for research, both theoretical and experimental. A steep-front electric wave is readily produced in a laboratory on a comparatively short stretch of single-phase line or cable. The line is connected to a source of direct-current voltage at one end, while the other end is kept open. If now this latter end be suddenly short-circuited, a steep-front wave starts from the generator and travels along the line. A series transformer and any protective devices under test connected to the line will then be subjected to this surge. Its effect may be studied, using a spark gap or some other more delicate measuring device for recording transient phenomena.

An investigator will find some information on the subject scattered in various European electrical periodicals, though the problem has not been solved by any means. The Swiss recommendations for the protection of station apparatus against surges deserve particular mention. They will be found translated into English in the *Electrician* (London) of Oct. 27, 1916.

Pulverized Coal Burners Versus Stokers

Relative Efficiencies—Conditions Under Which Powdered Coal Is Preferable—Comparative Freight Charges on Low and High-Grade Fuel—Price That Can Be Paid for Fuel

BY JOSEPH T. FOSTER
Engineering Department Public Service Electric Company of New Jersey

CONSIDERABLE attention has been devoted during the past year to the subject of burning pulverized fuel. The results of numerous tests have been reported, and in most cases these have been considerably higher than the corresponding efficiencies from mechanically operated stokers. The number of plants burning pulverized coal is quite large, and it has been estimated that 10,000,000 tons of coal is burned annually in this manner. It should be noted, however, that electric central-station companies, which as a class are usually the leaders in all attempts to secure greater fuel economy, have not adopted this method to any great extent.

The chief reason seems to be the fact that the mechanical stoker has been brought to a high degree of perfection as regards both fuel economy and ease and reliability of operation. It is therefore evident that central stations have been far more advanced than other coal consumers and that the latter in burning their coal in the pulverized form are merely adopting a substitute for the stoker.

Published test results indicate an efficiency of approximately 80 per cent, but there appears to be no reason to believe that such a figure could be maintained under conditions of continuous operation, and it is probable that no better than 75 per cent will be realized under these conditions. A well-designed stoker will show an efficiency of 70 per cent or better continuously, and it will therefore be difficult if not impossible for the pulverized fuel burner to displace the mechanical stoker.

There are no doubt special cases in which pulverized coal will receive consideration in determining what type of combustion apparatus will best meet a given set of conditions. For example, pulverized coal would be preferred in the following cases:

1. Where a large supply of low-grade coal is available at an attractive price.

2. Where the supply of fuel for gas or oil burning furnaces has been cut off or materially advanced in price.

3. Where the moisture content of the raw fuel already in use is so high as to require special treatment in the way of drying.

In comparing low-grade fuel with the quality of fuel ordinarily supplied to mechanical stokers it must be borne in mind that a greater tonnage of the low-grade fuel will have to be handled. For example, assuming 10,000-B.t.u. (1140 cal.) pulverized coal can be burned with 75 per cent efficiency compared with 70 per cent for

14,000-B.t.u. (1596-cal.) stoker coal, then it will be necessary to consume about 30 per cent more of the lower-grade coal for a given output.

To determine the maximum price which could be paid for low-grade coal to place it on a basis comparable with good coal the following formula may be used:

$$P_1/P_2 = (H_1/H_2)\ (E_1/E_2),$$

where

P = price per ton delivered,
H = B.t.u. content per pound,
E = combined boiler efficiency,

and the subscripts 1 and 2 refer to the low-grade and high-grade fuels respectively.

To show the use of this formula, assume a price of $5.50 for 14,000-B.t.u. coal delivered to stations on the Atlantic seaboard, the freight charge making up $2.50 of this total. Required the amount which could be paid for 10,000-B.t.u. coal.

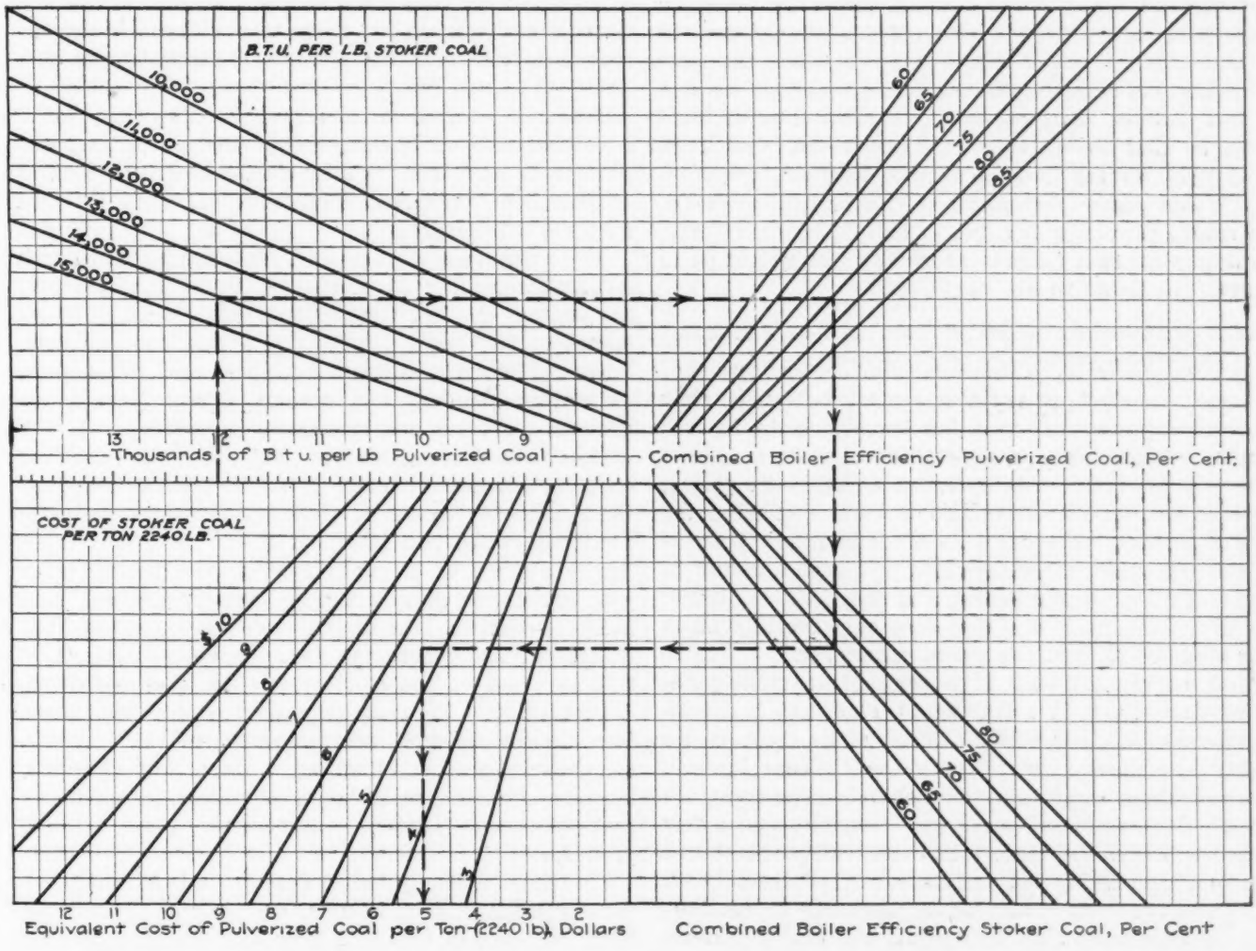
$P_1 = \$5.50 \times (10{,}000/14{,}000) \times (75/70) = \$4.20.$

Deducting freight to the amount of $2.50 per ton leaves $1.70 as the cost at the mines, and unless the fuel could be obtained at this price or less there would be no advantage in pulverizing. No account has been taken of the cost of pulverizing and drying, and this amount, which will be 30 cents or more per ton, would require that coal be obtainable at the mines for $1.40 per ton.

The foregoing example is worked out for a given set of conditions, but by means of the accompanying chart a comparison can be obtained for fuels of various grades under different combustion efficiencies. The use of the chart will be illustrated by the following example:

Problem.—A supply of 12,000-B.t.u. coal is available. What is the maximum amount (exclusive of cost of drying and pulverizing) which could be paid for the low-grade coal delivered to make it comparable with 14,000-B.t.u. coal at $5.50 per ton? Combined efficiency assumed at 75 per cent for the pulverized fuel and 70 per cent for raw fuel fired on stokers.

Solution.—From 12,000 B.t.u. on the pulverized coal scale project upward to the 14,000-B.t.u. line for stoker coal, then horizontally to the right to the 75 per cent efficiency line, vertically downward to the 70 per cent line, horizontally to the right to the line representing $5.50 coal, then vertically downward. Read on the scale



MAXIMUM AMOUNT THAT CAN BE PAID FOR PULVERIZED COAL TO MAKE IT COMPARABLE WITH A GIVEN STOKER COAL

the equivalent cost for low-grade fuel as $5 per ton delivered. The five-dollar price, of course, includes freight but does not include the cost of drying and pulverizing the fuel, which will vary from 20 to 50 cents per ton.

The foregoing views are confined entirely to the consideration of a new installation. It is probable, however, that in changing over an existing plant from hand firing or old-type stokers to a more modern arrangement capable of higher forcing rates the pulverized fuel equipment would cost less than a stoker installation.

This phase of the subject, with estimates of comparative costs, the author will cover in a later article.

Statistics in Accident Prevention

Analysis of 1172 Cases During Two-Year Period, Giving Data on Days Lost and Division of Cost, Points to Need of Guards, Inspection Service and Education of Employees in the Promotion of Safe Working Conditions

BY EVELYN M. DAVIS
Statistician Utilities Mutual Insurance Company

AN INTELLIGENT approach to the study of industrial accident prevention must of necessity be made through a careful record and examination of the statistics on the cases, and it was with this thought, and in the belief that such study would tend to indicate where the more serious accidents might be eliminated, that the Utilities Mutual Insurance Company undertook such a survey. This company was organized in 1914 by the public utility interests when the compensation act became operative in New York State, and it has confined itself exclusively to that class of business, so that to-day there are about 150 New York properties insured by it in respect to their compensation needs. The consequence of this restriction makes its record peculiarly valuable to the public utility man, as it may act as a guide to show where he should go to prevent accidents to his employees.

Delay Necessary in Arriving at Cost of Accidents

It is a peculiarity of the compensation business that the exact cost of an accident cannot be immediately known, as in the case of a fire loss, since the injured employee must receive compensation until he is able to return to work, and this is always an indefinite period, because no one is in a position to know just when the return to work will occur. As a consequence, it necessitates the study of the accidents that have occurred in a more or less remote period, and the Utilities Mutual Insurance Company has therefore only recently made this study of its first two years' experience.

This survey involved 1172 accidents occurring between June 30, 1914, and June 30, 1916, and is a complete record of the accidents incurred by those public utility companies insuring with the Utilities Mutual. Most of these companies were electric companies, although there were numerous gas companies and a few street railways. Of these 1172 cases, full payment had been made on all but ten and the cases had been closed, but these ten involve continuing disability or continuing dependency, so that their actual and final cost could not be absolutely determined, although estimates could be made which would very closely approximate the actual cost.

The study, as is indicated by the charts, attempts to segregate the accidents with respect to occupation, both as to the percentage of total days lost time and the percentage of total cost chargeable against each occupation. The accidents are also analyzed as to causes with respect to the percentage assignable to each cause, percentage of total days lost and percentage of total cost assignable to each cause.

The total number of days lost per accident is certainly a very fair indicator of the seriousness of the accident; but from a purely business basis the more satisfactory figure, and the one harder to obtain, is the cost of each accident.

It is self-evident that these two chart classifications, first as to occupation and then as to cause, will develop in a very different way where the serious accidents are occurring.

Theoretically the curves of days lost and cost should parallel each other, but there is a difference, for the very good reason that in some fatal cases, figured on a basis of twenty-five years' lost time, there will be no dependents, whereupon the state prescribes that the insurance carrier is liable for only $100 burial fees and $100 to be paid into the state fund. The time element is, therefore, very much overburdened, while the cost factor is a minimum.

The percentage of total days lost chargeable to each accident according to occupation shows that over 94 per cent of the lost time among public utilities is assignable to seven different occupations—linemen, laborers, firemen, switchboard operators, groundmen, carpenters, painters and masons (these three being grouped together) and locomotive engineers—and it is noticeable in this regard that these seven classifications each include one or more fatalities, as indicated by the figures in the circle. It may, therefore, be quite positively stated that in public utility operations fatalities are the ones to guard against, particularly when the last three classifications—linemen, laborers and firemen—where a total of twelve deaths is recorded out of sixteen and where the total days lost amount to 72.8 per cent of the entire lost time, are considered.

Proceeding to the chart on costs, it is seen that there is a slightly different rearrangement of the schedule, as shown by the following: Days lost—linemen, laborers, firemen, switchboard operators, groundmen; cost — linemen, laborers, carpenters, etc., firemen, groundmen.

This may be finally boiled down to a bare statement that in public utilities laborers and linemen account for 58.62 per cent of the total time lost due to accidents, while they account for 49.05 per cent in respect to the cost.

Five Classifications Cover Causes

The analysis of these 1172 accidents as to cause shows that explosives, electricity, fires and hot and corrosive substances; falls of persons; boilers and steam-pressure apparatus, machinery and handling objects account for more than 95.85 per cent of the total time lost, and it is found that these five classifications contain all of the fatalities reported in the two-year period.

In respect to the total cost, there is a slight rearrangement of the classifications again, as shown by the following: Days lost—explosives, electricity, etc.,

falls of persons, boilers and steam pressure apparatus, machinery, handling objects; cost—falls of persons, explosives, electricity, etc., boilers, and steam-pressure apparatus, handling objects, machinery.

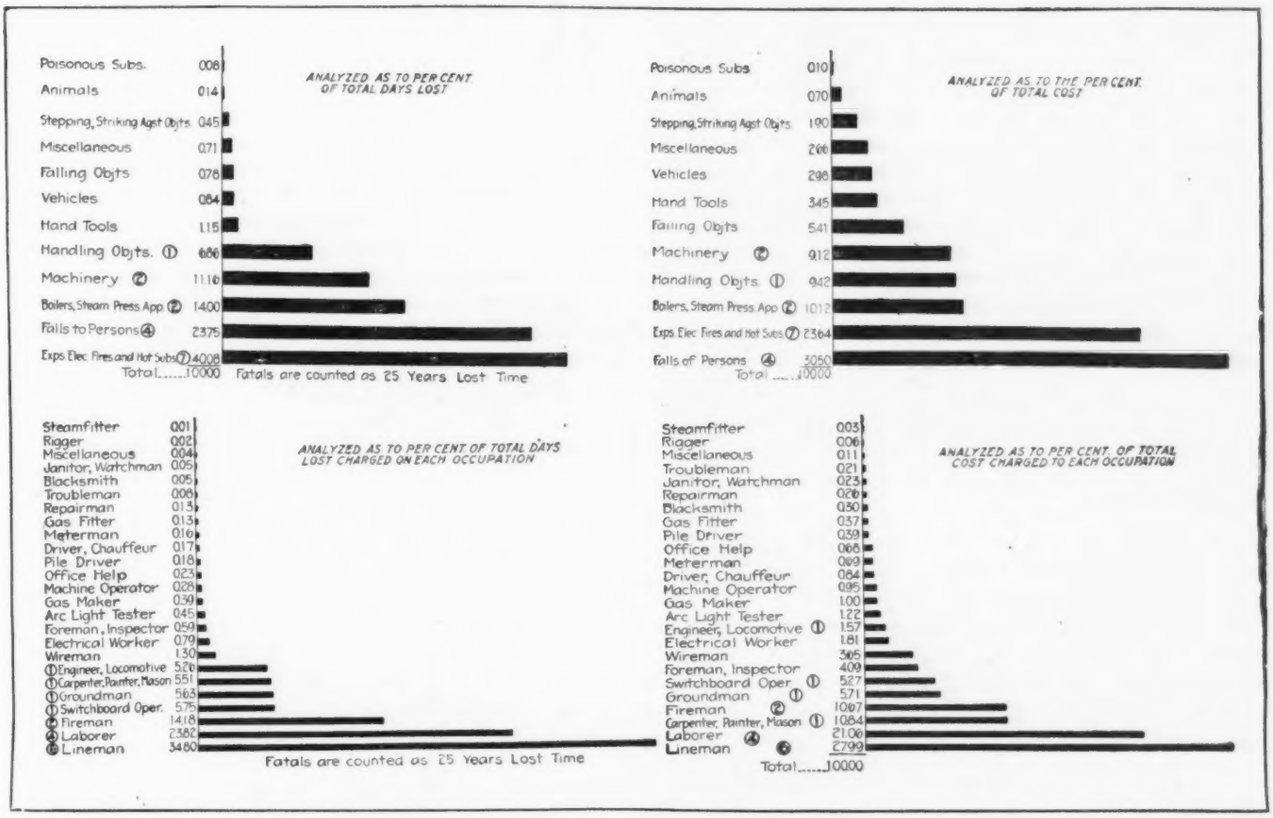
These five classifications account for 82.80 per cent of the cost of accidents, and aside perhaps from the classification "falling objects," which contributed 5.41 per cent of the cost, it may be said that these five classifications are the ones that should receive the greatest attention.

Summarizing, therefore, it may be definitely stated that the public utilities should exercise their greatest care for the protection of their employees, first, where linemen are concerned; second, among laborers; third, firemen; fourth, switchboard operators; fifth, groundmen; sixth, carpenters, painters and masons; seventh, locomotive engineers. They should particularly guard against accidents arising from the operation of, first, falls of persons; second, explosions, electricity, etc.; third, operation of boilers, steam, etc.; fourth, handling of objects; fifth, machinery. If conditions are still further analyzed, it may be positively stated that electric current and the boiler room are two of the three principal contributors to accidents among public utilities.

Such an analysis as the above should be the first study in accident prevention, and the second should be to provide the guards, the inspection service and the education to the employees needed to prevent these accidents. It is unquestionably true that the education is the very much more difficult portion of the work, but it cannot be intelligently undertaken unless such statistics as presented above have been accumulated.

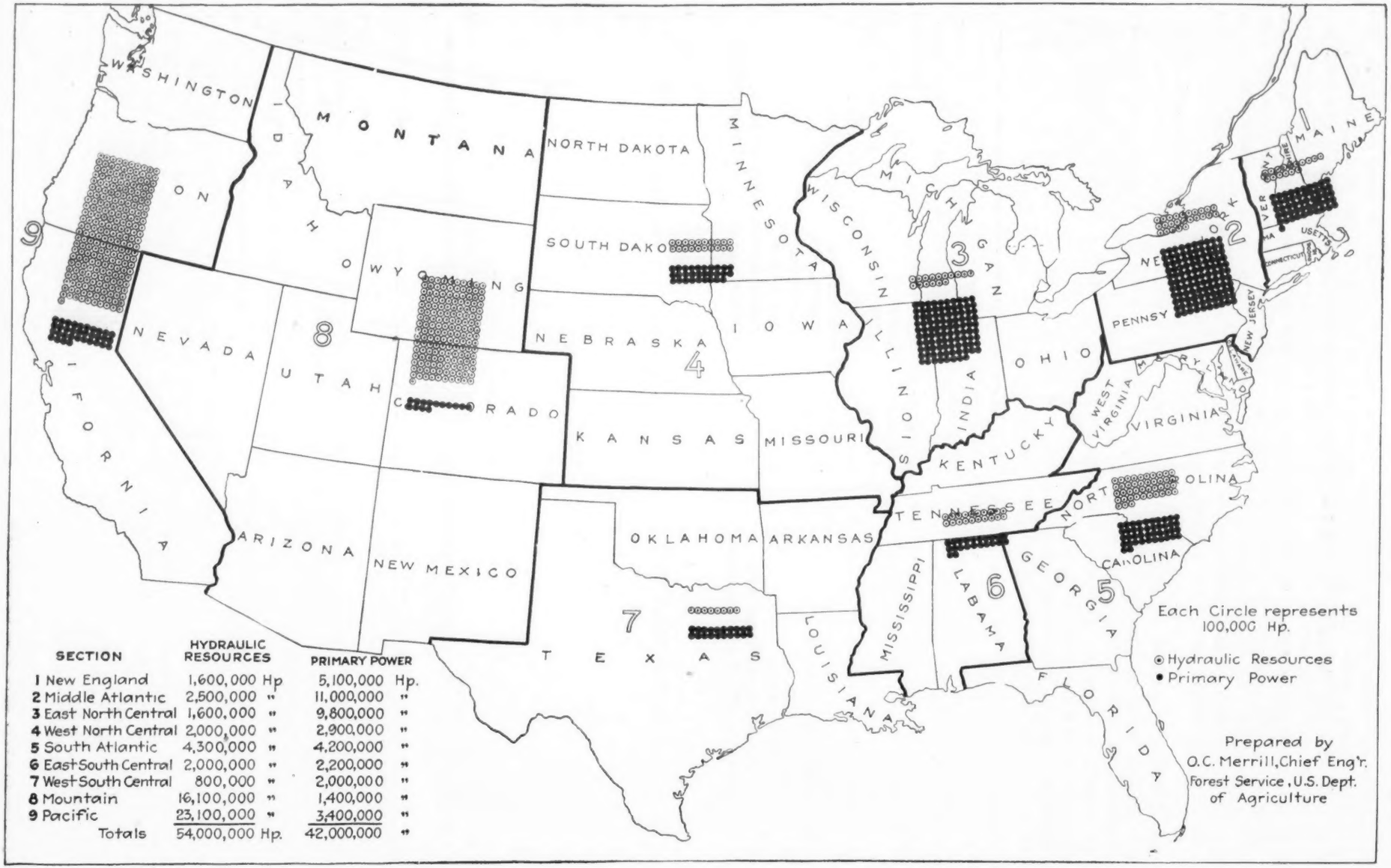
As an indication of what the above facts mean, falls account for 13 per cent of the 1172 accidents, or an actual number of 148; 24 per cent of the total lost time, or 33,000 working days, is assignable to this one cause, while 31 per cent of the total cost, or $23,800, is contributed by falls alone. Again, linemen alone fell often enough to absorb 73 per cent of these 33,000 lost working days and 53 per cent of the cost, $23,800. The moral of this is "Watch your step."

On the other hand, electricity contributed 11 per cent of the total number of cases, or 119 accidents: 40 per cent of the lost time, or 55,300 working days, and 24 per cent of the total cost, or $18,400. Under the heading "electricity" linemen absorbed 23,000 days lost, at a cost of $4,497; laborers in the plant 15,000 days lost, at a cost of $5,200; switchboard operators, 7900 days lost, at a cost of $4,017, and wiremen 1735 days lost, at a cost of $2,722. If, therefore, accidents to these four classes of workmen about public utility plants are eliminated, 85 per cent of these lost working days and 87 per cent of this accident cost will be saved.



GRAPHICAL ANALYSIS OF 1172 ACCIDENTS OCCURRING IN TWO-YEAR PERIOD

FIRST of all, the hand of friendship for that new American, the voice of a friend who shall be an unselfish adviser, a guide in this strange land of troubles, small and large, but equally incomprehensible. Then the school, the night school, or if not that, the shop school. And with these the community center, the gathering place that represents all America. —*Secretary of the Interior Franklin K. Lane.*



SECTION	HYDRAULIC RESOURCES	PRIMARY POWER
1 New England	1,600,000 Hp	5,100,000 Hp.
2 Middle Atlantic	2,500,000 "	11,000,000 "
3 East North Central	1,600,000 "	9,800,000 "
4 West North Central	2,000,000 "	2,900,000 "
5 South Atlantic	4,300,000 "	4,200,000 "
6 East South Central	2,000,000 "	2,200,000 "
7 West South Central	800,000 "	2,000,000 "
8 Mountain	16,100,000 "	1,400,000 "
9 Pacific	23,100,000 "	3,400,000 "
Totals	54,000,000 Hp.	42,000,000 "

DISTRIBUTION OF HYDRAULIC RESOURCES AND PRIMARY POWER BY SECTIONS, 1918

Hydraulic resources from Table No. 2, Part II, Senate Document No. 316, Sixty-fourth Congress, first session. Primary power, which consists of the installed capacity of water-wheels, steam engines and gas engines in commercial and municipal central stations, street and electric railways and manufacturing plants, has been estimated for 1918 by assuming a rate of increase in each state from 1912 to 1918 corresponding to the rate of increase for such state from 1902 to 1912, as indicated by the data given in Table No. 4, Part II of the above-named Senate document. The figures given do not include the horsepower of railroad locomotives.

Market for Electrical Goods in South America—II

Brief Notes on Bolivia, Ecuador and British Guiana, Together with a Resume of South American Conditions as a Whole—List of Central Stations in Chile, Uruguay, Ecuador and Peru

BY PHILIP S. SMITH
Trade Commissioner, Bureau of Foreign and Domestic Commerce

WHILE the account of conditions and opportunities in Brazil, Argentina and other countries printed in the ELECTRICAL WORLD for Feb. 22 covered all the principal commercial territory in South America, the following notes, omitted from that issue, will tend to make the record complete and a condensed view of the whole field is given in the résumé that follows.

BOLIVIA

The only users of electrical material in quantity in Bolivia are the mining companies, and as those have been enjoying several years of prosperity, they will probably purchase more heavily than ever in the near future. Each has its own generating plant, operated by water power or petroleum engines. The number of motors installed is being increased constantly. Personal representation is necessary to obtain this business.

For domestic purposes electric devices are confined to three or four towns, since the greater portion of the population consists of Indians and halfbreeds, who will never become users of this material.

Under present conditions there is little opportunity for the sale of anything but lamps and wiring material.

ECUADOR

Ecuador is one of the least developed of the South American republics. Its population is largely scattered throughout the country, there being only three cities of any importance. It is essentially an agricultural country, deriving most of its revenue from cocoa, ivory nuts, and hats made from the fiber of certain palm trees.

There are some twenty central stations, and outside of Guayaquil, where there are a few small industries using power, the electrical goods that can be sold are confined to lamps and wire and wiring devices. The purchasing population, as will be seen from the table, is extremely small.

BRITISH GUIANA

A small amount of electric material is consumed in Georgetown, where there is a central station and a street-railway system. In the interior there is practically no civilization other than a few towns situated at some distance from the capital.

A tremendous quantity of water power is available, including the famous Kaiteur Falls, where the power is estimated at two to three times that of Niagara Falls. Here again, however, it is too far removed from civilization to be of any value at present.

RESUME

It was previously pointed out that the population census does not afford a true criterion of the value of the South American market. Mention has been made also of the lower purchasing power of the average individual, in consequence of which the cheaper goods have a greater acceptance than those of higher cost.

The climate, too, must be taken into consideration, especially in regard to articles such as fans and heating devices. Nearly all the continent lies within the tropics, but this does not mean that it is hot the year round. The altitude makes a great difference, and much of the inhabited land reaches an elevation of 1000 ft. to 12,000 ft.; so that even in places as near the equator as Quito or Bogota overcoats and blankets are not out of place at certain times of the year. At sea level the temperature on the west coast is not excessively high.

The natural tendency of the people as a whole is toward conservatism; consequently new devices are adopted very slowly. This is shown in a striking manner by the fact that even in such cities as Santiago and Buenos Aires, where the temperature falls to freezing point occasionally and for two or three months hovers around 50 degrees Fahrenheit, no provision is made for warming the houses. By many it is considered unhealthful to have any artificial heat in homes and offices. This feeling is disappearing gradually, however, and an example is being set by hotels, office buildings and modern apartments, which are now installing either some central-heating system or means for local heating.

Such wiring rules as there are permit the use of European designs, which in many things, particularly wiring devices, are much cheaper than American. There is little prospect of a radical change in this situation at an early date, though there is a strong movement toward an elevation of standards. That this condition exists is not at all surprising, since for many years European factories and merchants have had agents and representatives on the ground advertising and pushing their goods. It was part of their propaganda to secure the adoption of specifications and regulations favoring their own products, and as Americans offered little or no resistance, the European representatives soon had everything on a basis as advantageous to themselves as it was disadvantageous to us. In addition, they have established strong banks and commercial houses in large and small cities and have earned through hard work the trade that is theirs.

During the last three years American banks have been established in a number of cities, so that to-day there is no considerable importing center without one. Any manufacturer, therefore, who does wish to enter this field will find that he is able to secure credit information through them, as well as much other assistance, including the handling of documents, with the result that if care is used in the selection of persons to whom credit is extended, the loss on accounts will be practically nothing.

LIST OF CENTRAL STATIONS IN CHILE, URUGUAY, ECUADOR AND PERU

CENTRAL STATIONS IN CHILE

Location and Nature of Plant	Motive Power	Total Capacity, Kw.	Characteristics of House and Power Circuits	Make of Machinery
ANCUD				
Luz Eléctrica Ancud	Steam	25	230-volt D.C.	German
ARICA				
Cia. Alumbrado de Arica	Petroleum	200	220/440-volt D.C.	American
ANTOFAGASTA				
Cia. de Electricidad Antofagasta.	Petroleum	1000	220/440-volt D.C.	English
BUIN				
Luz i Fuerza Electrica de Buin...	Pet., steam and water	590	110 and 220-volt A.C. 1 Ph., 50 Cy.	German
CALERA				
Cia. Luz Electrica de Calera	Water	40	220/440-volt D.C.	German
CHILLAN				
Cia. General de Electricidad Industrial	Water	510	250/500-volt D.C.	German
CONCEPCION				
Cia. de Luz Electrica de Concepción	Steam	1,350	230/460-volt D.C.	German
Cia. Electrica de Concepción	Steam	600	550-volt D.C.	American
COQUIMBO				
Empresa Electrica de Coquimbo.	Pet. and gas	280	220/440 volt D.C.	American and German
CORONEL				
Cia. de Luz Electrica de Coronel.	Steam and gas	175	220-volt D.C.	German
COYA				
Braden Copper Company	Water	13,000	2300-volt A.C. 3-Ph., 60 Cy.	American
CRUZ GRANDE				
Bethlehem Chile Iron Mines Company	Steam	7,300	2300-volt A.C. 3-Ph., 60-Cy.	American
(Railway voltage, 1200 volts and 2400 volts, D.C., power voltage, 220/440 or 2300-volt A.C., three-phase, 60 cycles.)				
CURICO				
Cia. Electrica de Curicó	Water	350	220-volt A.C. 3 Ph., 50 Cy.	German
Cia. General de Electricidad Industrial	Pet. and water	200	220/440-volt D.C.	German
IQUIQUE				
Cia. de Alumbrado	Pet. and gas	1,300	110-volt A.C. 1 & 2-Ph., 60 Cy.	American and English
LINARES				
Empresa Eléctrica	Water	35	220/440-volt D.C.	English
LLAILLAI				
Empresa Eléctrica	Pet. and water	275	220/440-volt D.C.	German
LONCOCHE				
Luz Eléctrica de Loncoche	Steam	55	250-volt D.C.	German
LA SERENA				
Empresa Eléctrica	Pet, steam and water	400	220/440-volt D.C.	English and German
LA UNION				
Empresa Eléctrica	Water	250	220-volt A.C. 1-Ph., 50 Cy.	German
LOS ANDES				
Cia. Eléctrica de Los Andes	Steam and water	600	210-volt A.C. 1-Ph., 50 Cy.	German
LOS ANJELES				
Empresa Eléctrica	Water	125	115/230-volt D.C.	German
LO BRAVO				
Cia. General de Electricidad Industrial	Steam and water	175	110/220-volt A.C. 1-Ph., 50 Cy.	English
MEJILLONES				
Antofagasta & Bolivia Railway Company	Steam	570	250/500-volt D.C.	English
OSORNO				
Empresa Eléctrica	Steam	450	220/440-volt D.C.	German
OVALLE				
Empresa Eléctrica	Petroleum	45	220/440-volt D.C.	German
PANGAI				
Braden Copper Co	Water	15,000		
PUERTO MONTT				
Luz Eléctrica de Puerto Montt	Steam	14	230-volt D.C. 1 and 3 Ph., 60 Cy.	German
PUNTA ARENAS				
Cia. de Alumbrado Eléctrico de Punta Arenas	Pet. and steam	1,350	100 and 220-volt A.C. 1 and 3-Ph., 60 Cy.	English
QUILLOTA				
Empresa Eléctrica	Petroleum	250	220/440-volt D.C.	English and German
RANCAGUA				
Cia. General de Electricidad Industrial	Steam and water	100	220/440-volt D.C.	German
SANTIAGO				
Chilian Electric Tramway & Light Company, Ltd.	Steam and water	15,300-water 14,000-steam	220/440 D.C.	German
SAN BERNARDO				
Ferro Carril Eléctrico de San Bernardo a Santiago	Steam, gas and water	500	220-volt A.C. lights, 550-volt D.C. street ry.	American and German
SAN FELIPE				
Cia. Luz Eléctrica de San Felipe	Gas and water	200	220/440-volt D.C.	English and German
SAN FERNANDO				
Cia. General de Electricidad Industrial	Gas and water	100	220/440-volt D.C.	English
TACNA				
Empresa Eléctrica de Tacna	Petroleum	280	220/440-volt D.C.	American
TALCA				
Empresa Eléctrica	Water	200	220/440-volt D.C.	German
TADCAHUANO				
Cia. de Luz Eléctrica	Gas	170	220/440 volt D.C.	English
TALTAL				
Taltal Electric Light Co	Petroleum	90	250-volt D.C.	American
TEMUCO				
Cia. Genral de Electricidad Industrial	Water	460	220/440-volt D.C.	Amer. and German
TOCOPILLA				
Empresa Eléctrica	Petroleum	50	220-volt D.C.	German
Chilian Exploration Company	Steam	40,000		German
(Transmission to the mines at Chuquicamata at 110,000 volts, three-phase 60 cycles.)				
TOME				
Cia. de Luz Eléctrica	Steam	100	230/460-volt D.C.	German
VALDIVIA				
Cia. de Luz Eléctrica de Valdivia.	Steam	780	220/440-volt D.C.	German
VALLENAR				
Cia. Eléctrica de Vallenar	Gas	40	230-volt D.C.	German
VALPARAISO				
Cia. Tranvias Eléctricas de Valparaiso	Steam and water	3,600-water 2,000-steam	220/440-volt D.C.	German
VICTORIA				
Empresa Eléctrica	Steam	82	220-volt D.C.	German
VIN VINA DEL MAR				
Empresa Eléctrica	Steam and gas	700	220/440-volt D.C.	English
YUMBEL				
Empresa Eléctrica	Water	32	220-volt D.C.	German

CENTRAL STATIONS IN URUGUAY

CANELONES				
Usinas Eléctricas del Estado	Petroleum	55	220-volt D.C.	American
CARMELO				
Empresa Eléctrica de Carmela	Petroleum	118	220-volt D.C.	
COLONIA				
Usinas Eléctricas del Estado	Steam	495	220-volt A.C. 3-Ph., 50 Cy.	German
DURAZNO				
Empresa Eléctrica de Durazno	Producer gas	163	220-volt D.C.	German
FLORIDA				
Empresa Eléctrica de Florida	Petroleum and producer gas	191	150-volt D.C.	
FRAY BENTOS				
Municipalidad de Fray Bentos	Steam	80	110-volt D.C.	
LA PAZ				
Usinas Eléctricas del Estado	Substation fed from Montevideo		220-volt A.C. 3-Ph., 50 Cy.	
LAS PIEDRAS				
Usinas Eléctricas del Estado	Substation fed from Montevideo		220-volt A.C. 3-Ph., 50 Cy.	
MALDONADO				
Usinas Eléctricas del Estado	Petroleum	160	220-volt A.C. 3-Ph., 50 Cy.	Swiss
MELO				
Empresa Eléctrica de Melo	Steam	190	220-volt D.C.	
MERCEDES				
Empresa Eléctrica de Mercedes			135-volt A.C. 1-Ph., 50 Cy.	
MINAS				
Empresa Eléctrica de Minas			135-volt A.C. 1-Ph., 50 Cy.	
MONTEVIDEO				
Usinas Eléctricas del Estado	Steam	17,000	220-volt A.C. 3-Ph., 50 Cy.	
(To be increased to 27,000 kw., with the installation of the new turbo-generator unit bought in the United States—General Electric Co.—in 1918.)				
PANDO				
Usinas Eléctricas del Estado	Petroleum	160	220-volt A.C. 3-Ph., 50 Cy.	Swiss
PAYSANDU				
Empresa Eléctrica de Paysandú			220-volt D.C.	
PUNTA DEL ESTE				
Usinas Eléctricas del Estado	Substation fed from Maldonado		220-volt A.C. 3-Ph., 50 Cy.	

LIST OF CENTRAL STATIONS IN CHILE, URUGUAY, ECUADOR AND PERU *(Continued)*

Location and Nature of Plant	Motive Power	Total Capacity, Kw.	Characteristics of House and Power Circuits	Make of Machinery
RIVERA				
Empresa Eléctrica de Rivera			220-volt D.C.	
ROCHA				
Empresa Eléctrica de Rocha			220-volt D.C.	
SALTO				
Empresa Eléctrica de Salto			220-volt D.C.	
SAN CARLOS				
Usinas del Estado	Substation fed from Maldonado		220-volt A.C. 3-Ph., 50 Cy.	
SAN JOSE				
Empresa Eléctrica de San José			220-volt D.C.	
TACUAREMBO				
Usinas del Estado	Steam	150	220-volt D.C.	
TRINIDAD				
Empresa Eléctrica de Trinidad	Petroleum	219	220-volt D.C.	German

The Administration General of the Usinas Eléctricas del Estado is ready to undertake the establishment of plants in the following places as soon as the conditions are more favorable: Artigas, Dolores, José Battalle y Ordoñez, Nueva Palmira, Rosario, San Eugenio, Santa Lucia, Sarandi del Yi, Trinta y Tres.

CENTRAL STATIONS IN ECUADOR

Location and Nature of Plant	Motive Power	Total Capacity, Kw.	Characteristics of House and Power Circuits	Make of Machinery
AMBATO				
Municipalidad de Ambato	Water	200	110-volt A.C. 1-Ph., 60 Cy.	American
AZOGUES				
Cía. Trifásica de los Rios	Petroleum	30	120-volt A.C. 1-Ph., 60 Cy.	American
BABAHOYA				
Cía. Trifásica de los Rios	Petroleum	100	120-volt A.C. 1-Ph., 60 Cy.	American
CAJABAMBA				
Municipalidad de Cajabamba	Water	40	110-volt A.C. 1 Ph., 60 Cy.	American
CAYAMBO				
Municipalidad de Cayambo	Water	40	110-volt A.C. 1 Ph., 60 Cy.	American
CUENCA				
Municipalidad de Cuenca	Water	375	110-volt A.C. 1 Ph., 60 Cy.	American
Roberto Crespo O.	Water	100	110 volt A.C. 1 Ph., 60 Cy.	American
CHONE				
Municipalidad de Chone	Steam	50	110-volt A.C. 1Ph., 60 Cy.	American
GUANO				
Cía. Trifásica de los Rios	Water	50	110-volt A.C. 1 Ph., 60 Cy.	American
GUARANDA				
Cía. Trifásica de los Rios	Water	120	110-volt A.C. 1 Ph., 60 Cy.	American
GUAYAQUIL				
Empresa Luz y Fuerza Eléctrica	Steam and pet.	1000	110-volt A.C. 1 Ph., 42 Cy.	French
HUIGRA				
Guayaquil & Quito Railway	Water	20	120-volt D.C.	American
IBARRA				
Municipalidad de Ibarra	Water	50	220-volt D.C.	American
LATACUNGA				
Municipalidad de Latacunga	Water	50	110-volt A.C. 1 Ph., 60 Cy.	American
LOJA				
Empresa Luz Eléctrica de Loja	Water	40	220-volt D.C.	American
MACHACHI				
Cía. Trifásica de los Rios	Water	60	120-volt A.C. 1 Ph., 60 Cy.	American
MILAGRO				
E. Morgner & Co.	Steam	2	120-volt D.C.	
OTOVALO				
Compañía Pinto	Water	30	110-volt A.C. 1 Ph., 60 Cy.	American
PUJILI				
Municipalidad de Pujilí	Water	30	110-volt A.C. 1 Ph., 60 Cy.	American
QUITO				
Quito Electric Light & Power Co.	Water	600	110-volt A.C. 1 Ph., 60 Cy.	American
RIOBAMBA				
Granize & Falconi	Water	250	110-volt A.C. 1 Ph., 60 Cy.	American
VINCES				
Cía. Trifásica de los Rios	Petroleum	50	120-volt A.C. 1 Ph., 60 Cy.	American

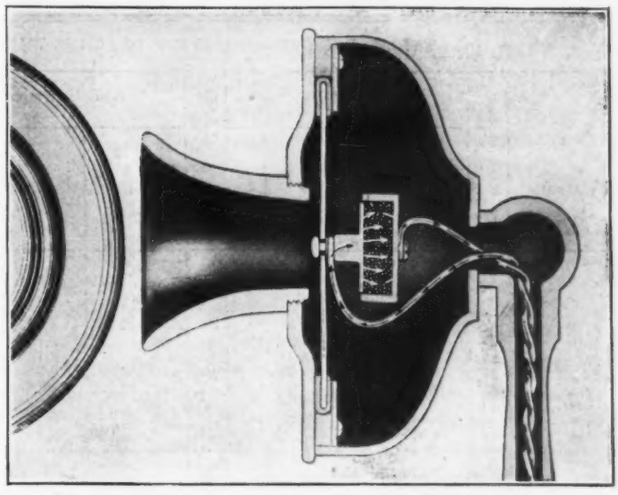
CENTRAL STATIONS IN PERU

Location and Nature of Plant	Motive Power	Total Capacity, Kw.	Characteristics of House and Power Circuits	Make of Machinery
AREQUIPA				
Sociedad Eléctrica de Arequipa	Water	1,760	220-volt A.C. 3-Ph., 50 Cy.	German
CASAPALCA				
Backus & Johnson	Water	2,300	110/440-volt A.C.	German
Ricardo Bentin	Water	500	110/220-volt A.C.	American and German
CUZCO				
Compañía Eléctrica Cuzco	Water	1,000	220-volt A.C. 3-Ph., 60 Cy.	Italian
CHICHA ALTA				
Empresa Eléctrica de Chicha Alta	Gas	50	110-volt D.C.	American
CHICLAYO				
Empresa Eléctrica de Chiclayo	Steam and gas	275	110-volt A.C. 3-Ph., 60 Cy.	Amer. and German
HUACHO				
Empresa Eléctrica de Huacho	Water	50	110-volt A.C. 3-Ph., 60 Cy.	American
HUANCAYO				
Martinelli Hermanos	Water	25	220-volt A.C. 1-Ph., 50 Cy.	German
HUARON				
Compañía Mina de Huaron	Water	200	220-volt A.C. 3-Ph., 50 Cy.	Amer. and German
ICA				
Empresa Eléctrica de Ica	Water	30	220-volt A.C. 1-Ph., 50 Cy.	German
JUNIN				
Eulogio Fernandini	Water	500	220-volt A.C. 3-Ph., 50 Cy.	German
LIMA				
Empresas Eléctricas Asociadas	Water and steam	12,000	220-volt A.C. 3-Ph., 60 Cy.	American
MOLLENDO				
Empresa Eléctrica de Mollendo	Petroleum	25	110-volt A.C. 1-Ph., 60 Cy.	American
OROYA				
Cerro de Pasco Mining Company	Water	20,000	220/550-volt A.C. 3-Ph., 60 Cy.	American
PISCO				
Empresa Eléctrica de Pisco	Petroleum	40	240/480-volt D. C.	American
PUNO				
Empresa Eléctrica de Puno	Steam	55	110 A.C. 3-Ph., 60 Cy.	American
TALARA				
London & Pacific Petroleum Co.	Petroleum	700	110/440-volt A.C. 3-Ph., 60 Cy.	American
TARMA				
Empresa Eléctrica de Tarma	Water	40	220-volt A.C. 1-Ph., 50 Cy.	German
TRUJILLO				
Empresa Eléctrica de Trujillo	Water	60	220-volt A.C. 1-Ph., 50 Cy.	German

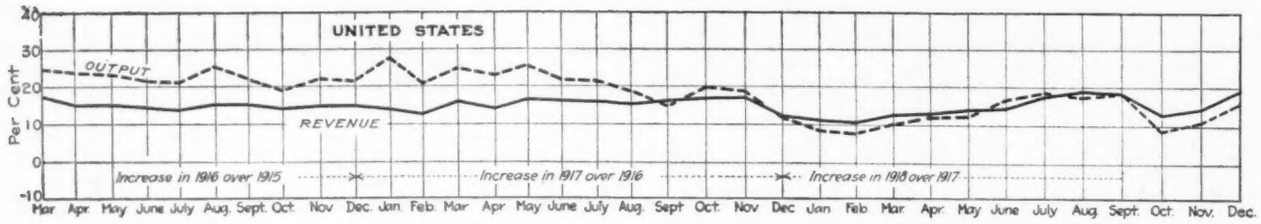
MOTION PICTURE SHOWS WHY TELEPHONE TALKS

A Visualization of What Happens Scientifically When This Instrument Is Used Interests Audience of Engineres

On Wednesday evening of last week, at the session of the American Institute of Electrical Engineers' mid-winter convention, the Bray Studios, Inc., New York, presented a motion picture that visualized what happens in a telephone. The spherical sound wave vibrates the diaphragm, which in turn varies the resistance of the carbon particles and causes the variation of current in the connecting wires. The picture was animated by E. Dean Parmelee and Max Fleisner.



Central Station December Operations


UNITED STATES
OUTPUT
REVENUE
Per Cent
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
Mar Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec.

THOUGH CONVERSION OF INDUSTRIES WAS UNDER WAY, DECEMBER SHOWED LARGE INCREASES

DECEMBER, 1918, operations of the central stations reporting to the ELECTRICAL WORLD show the large increase of 19.1 per cent in revenue and 15.6 per cent in kilowatt-hour output over December, 1917. The preliminary statistics are from 45 per cent of the industry and of course are subject to change when the returns are in from the 60 per cent of the industry usually represented in the compilation. This is a very favorable showing, and it reflects industrial activity of tremendous scope. The more striking item is the gain reported in revenue, which exceeds any other of the high rates of increase generally reported during the months of 1918. August showed 18.5 per cent gain, and July and September were not far from that figure, but the other months were substantially lower in percentage of gain. Output gains fluctuated to a greater extent during the months of 1918, and the December record of increase was below the returns of the four months from June to September inclusive. The December record, however, carries much encouragement.

The first month after the signing of the armistice, December was a time of partial transition. The manufacture of war munitions and supplies was continued to some extent, and where that policy was followed it meant sustained demand for electrical energy. Other influences, however, developed, among them the very sharp cancellation of contracts in many instances, the maintenance of production in certain cases with the object of lessening labor non-employment, and the rapid steps to restore normal peace-time industries. All of these factors are represented in the returns and it is to be expected that such influences will be reflected in the figures until the national and international situation has a greater measure of stability.

Based on the statistics from 45 per cent of the industry, the ELECTRICAL WORLD estimates for December for the entire industry are: Revenue, $51,651,000; output, 2,367,633,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1918	1917	Per Cent Increase	1918	1917	Per Cent Increase
Jan.	62	$27,035,000	$24,977,000	8.2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,319,444,000	16.0
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,156,692,000	18.5
Aug.	61	26,891,000	22,690,000	18.5	1,647,510,000	1,417,150,000	16.3
Sept.	60	28,051,000	23,810,000	17.8	1,579,149,000	1,348,820,000	17.0
Oct..	56	26,254,000	23,228,000	13.0	1,517,866,000	1,392,359,000	9.0
Nov.	53	25,149,000	21,873,000	14.1	1,251,805,000	1,119,929,000	10.9
Dec..	45	23,243,000	19,513,000	19.1	1,065,435,000	921,634,000	15.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States			Atlantic States			Central States			Pacific and Mountain States		
		Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase	Percentage of Industry Represented	1918	1917	Per Cent Increase
REVENUE	Jan	63	$3,393,000	$2,990,000	13.8	64	$9,677,000	$9,517,000	1.6	53	$8,862,000	$7,639,000	16.8	86	$5,113,000	$4,831,000	5.8
	Feb	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April	62	2,890,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	62	2,810,000	2,530,000	11.5	64	9,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June	63	2,925,000	2,584,000	13.3	63	10,048,000	8,761,000	14.7	49	8,124,000	6,824,000	19.0	84	4,973,000	4,432,000	12.2
	July	62	3,037,000	2,511,000	20.9	62	9,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	51	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sept	64	3,268,000	2,811,000	16.2	57	10,143,000	8,631,000	17.5	51	9,251,000	7,703,000	20.1	86	5,389,000	4,665,000	15.5
	Oct	63	3,360,000	3,036,000	10.6	51	8,822,000	7,924,000	11.3	50	9,218,000	7,848,000	17.4	81	4,854,000	4,420,000	9.8
	Nov	64	3,695,000	3,238,000	14.1	54	10,092,000	8,883,000	13.6	39	6,328,000	5,200,000	21.7	81	5,034,000	4,552,000	10.6
	Dec	64	4,097,000	3,449,000	18.7	44	9,406,000	8,038,000	17.0	34	6,621,000	5,318,000	24.5	62	3,119,000	2,787,000	15.2
KW.-HR OUTPUT	Jan	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July	62	135,960,000	105,373,000	29.0	62	518,566,000	439,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	51	447,829,000	399,278,000	12.1	85	488,433,000	413,350,000	18.1
	Sept	64	133,901,000	114,279,000	17.1	57	520,312,000	445,154,000	16.8	51	471,594,000	408,320,000	15.5	86	453,342,000	381,067,000	18.9
	Oct	63	139,784,000	128,970,000	8.3	51	481,222,000	440,268,000	9.3	50	479,990,000	442,054,000	8.5	81	416,870,000	381,067,000	9.4
	Nov	64	138,559,000	123,033,000	12.6	54	450,210,000	406,725,000	10.6	39	259,470,000	221,934,000	16.9	81	403,566,000	368,237,000	9.6
	Dec	64	145,543,000	129,838,000	12.1	44	373,150,000	327,539,000	13.9	34	268,213,000	231,530,000	15.8	62	278,529,000	232,727,000	19.6

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PENETRATION AND OVERLAP INDICATE WELD QUALITY

Easily Observed by Visual Inspection When Moving Arc Terminal Over Plate with Uniform Velocity

Penetration of deposit metal into the plate metal and overlap of the edge of the deposit layer on the plate are two good indications of the quality of a weld, said O. H. Eschholz in a paper presented before the American Institute of Electrical Engineers recently. Both of these can be observed by visual examination. The penetration ought to be at least $\frac{1}{16}$ in. (1.6 mm.).

Extreme overlap is sometimes due to a low-melting-point electrode or too great speed of arc travel. For a given arc current it has been the author's experience that fusion is not improved with increase in arc length, that the best weld characteristics are obtained when holding a short arc, not longer than $\frac{1}{8}$ in. (3.2 mm.) and preferably about $\frac{1}{16}$ (1.6 mm.). With a given arc length the ease of securing complete fusion increases with arc current until a maximum value is reached beyond which further increase results in a weakened weld structure.

When the molten material passes through a short arc it is quite completely enveloped by hot gases and suffers but a slight loss in temperature before being deposited. Upon drawing a long arc the air currents in its vicinity blow the arc stream and arc flame about violently, so that it is difficult to maintain the plate terminal of the arc in a given position long enough to effect sufficient penetration. Moreover, the energy absorbed from the arc stream and electrode terminal becomes practically negligible, owing to the greater diffusion of the radiation in the region of the arc plate terminal, while the energy absorbed from the molten metal is decreased because of the loss in temperature the deposit has sustained in transition.

Slight Overlap Often Permissible

For most purposes a slight overlap is permissible in single layers as a simple procedure of depositing the subsequent layers will fuse the overlapped areas. If the width of a layer is increased by weaving the electrode back and forth the percentage overlap will be decreased. However, it may be eliminated by the simple expedient of always overlapping adjacent layers.

To minimize the occurrence of unfused areas, the melting point of the electrode metal should exceed that of the plate metal. The melting point of most weldable steels may be gaged with sufficient accuracy by their carbon content.

While pure iron possesses the highest melting point, its use is not advisable since excessive oxidation of the vaporized metal occurs. However, a commercially pure iron alloyed with about 0.18 per cent carbon and 0.5 per cent manganese greatly reduces the oxidation and improves the ease of manipulation without an appreciable sacrifice in melting point. For most purposes the use of this electrode gives a reasonable minimum overlap.

Preheating Is a Good Practice

Under exceptional conditions, such as high thermal capacity of weld or overheat welding with a low current, it is advisable to preheat the object to be welded or to adopt a welding procedure which utilizes the thermal energy from preliminary welding operations to raise the temperature of the object welded, in order to prevent excessive overlap.

For a given plate thickness the welding current will vary with the type of weld scarf, cleanliness of surface, thermal capacity and conductivity of the metal, and position of plate with respect to the welder. Excessive overlap and unsatisfactory penetration may be caused by applying too small an amount of energy at the arc crater, whereas the excessive energy consumption at the plate arc thermal produces excessive penetration. Further increase in current causes cutting. Unskilled workers using full arc current can obtain about 85 per cent weld strength, whereas if the current drop to 80 per cent normal value only 40 per cent strength will be had.

For miscellaneous direct-current welding the densities usually fall within a range of 7000 amp. to 10,000 amp. per square inch, if an 0.18 per cent carbon-steel electrode is used. However, whenever practicable, the author prefers a closer range of 8000 amp. to 9000 amp. per square inch. With too great an electrode diameter for a given current, the arc becomes more unstable, increasing the manipulative skill required and decreasing the rate of depositing electrode material. Too small a diameter causes a deposition of electrode materail before the plate has been properly liquefied; it also results in overheating and softening of electrode, which increases the skill required to prevent the electrode "freezing" to the plate.

In butt welding $\frac{1}{2}$-in. (1.27-cm.) low-carbon steel plates $\frac{5}{32}$ in. (4 mm.) in diameter, welding electrodes containing approximately 0.18 per cent carbon and 0.5 per cent manganese, would preferably be used with an arc current of approximately 150 amp. With moderate skill the strength of weld should approximate 90 per cent that of the plate. If the same current and electrode diameter are used in welding a lap joint formed from $\frac{1}{2}$-in. plates, poor fusion will be obtained owing to the increased thermal capacity of the abutting sections. To secure complete fusion on both faces of a lap joint it is necessary to increase the arc current and with it the electrode diameter.

METER TERMINAL BLOCK THAT FACILITATES TESTING

Found Possible by Its Use to Double Number of Meters Tested by the Scranton Electric Company's Laboratory

BY JOS. N. MC CLURG, SOUTHERN ELECTRIC COMPANY

By using the terminal block shown in the accompanying illustration in testing meters it is unnecessary to remove the terminal covers of the meters. Thus the time ordinarily consumed in performing this operation as well as connecting the leads to the meters is saved. The

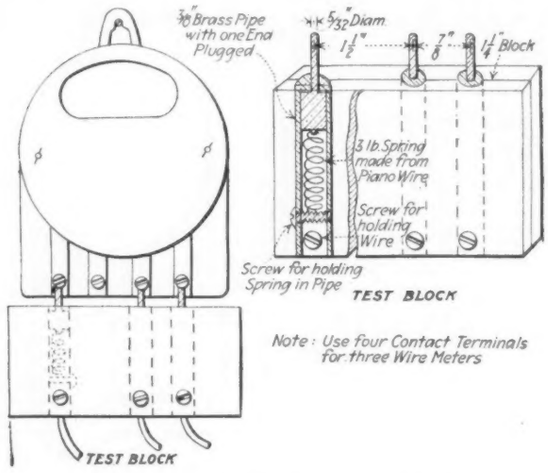

3/8" Brass Pipe with one End Plugged
5/32" Diam
1 1/2"
7/8"
1 1/4" Block
3 lb. Spring made from Piano Wire
Screw for holding Wire
Screw for holding Spring in Pipe
TEST BLOCK
Note: Use four Contact Terminals for three Wire Meters
TEST BLOCK

FIG. 1—METER-TESTING TERMINAL BLOCK

block is being used in the laboratory of the Scranton, (Pa.) Electric Company, where it has doubled the number of meters that can be tested per day.

The terminal is made from a piece of ¼-in. (6-mm.) brass pipe with one end plugged. In the center of this plug is an 11/64-in. (4-mm.) hole, in which the contact rod works freely. The end of the contact rod inside the pipe is fitted with a sort of piston which presses

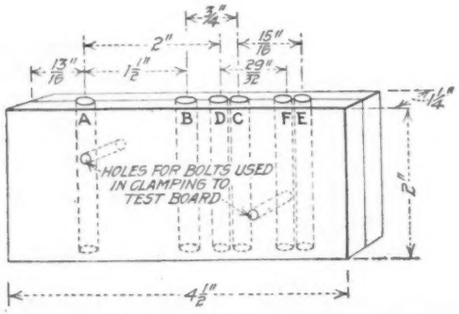


FIG. 2—TESTING BLOCK ADAPTED TO THREE MAKES OF METERS

against a spring made of steel piano wire. The latter exerts a force of 3 lb. (1.4 kg.) and thus insures good contact with the meter terminals without raising the meter from the supporting screws.

The particular terminal block shown is suitable only for testing meters the terminals of which are the same distance apart as those on the block. The principle shown can be applied, however, in making a terminal block which will be adaptable to several different types of meters. For instance. if G. E. types I14 and K5, Westinghouse type OA and Sangamo type H meters are to be tested, split terminal blocks 4½ in. (11.4 cm.) wide by 1½ in. (3.8 cm.) combined thickness can be provided with receptacles spaced as shown in Fig. 2. For testing the G. E. meters the terminals can be placed in holes *A*, *B* and *C;* for Westinghouse meters they can be placed in holes *A*, *D* and *E*, while for Sangamo meters the terminals can be inserted in holes *A*, *D* and *F*. The block is split to facilitate changing the positions of the terminals.

For holding the blocks securely against the test board bolts may be run through the blocks and test board and drawn up tight with wing nuts. To use the block with Westinghouse meters a ¼-in. (6-mm.) strip has to be inserted between the blocks and the test board to bring the terminals into the proper position.

The springs have been tested for heating, and it has been found that 25-amp. test current can be easily employed without overheating them.

FAILURES PROVE TO BE FEW IN REINSTALLED CABLE

Experience Shows the 9000-Volt and 12,000-Volt Lead-Covered Cable Can Be Pulled Out of Ducts, Reinstalled and Operated at Rated Potentials

The Commonwealth Edison Company, Chicago, began removing and reinstalling transmission cable on a large scale in the spring of 1917. On Sept. 8, 1917, after about 75 miles of the cable had been moved, the ELECTRICAL WORLD published an article showing something of the methods used in doing the work and stating that the approximate saving made at that time by reusing the old cable was about $200,000. The company has now moved 107 miles out of a total of 726 miles of 9000-volt and 12,000-volt cable which it owns. Hence the cable which has been moved amounts to 15 per cent of the total.

With such a large percentage of total cable transferred from one location to another a comparison of the annual records covering cost of repairing burn-outs is interesting.

Data on the cost of repairing burn-outs for 1914 and 1915 represent fairly well what the normal conditions were before reinstalled cable was used. In those years the expense of repairing burn-outs averaged about $13,800. Since the reinstalled cable has been operating (in 1917 and 1918) the cost of burn-outs has averaged $10,500. By these data it is not intended to prove that the simple act of reinstalling cable improves the quality of the cable, but it is a fact that when the cable is pulled out and inspected places are discovered in it which would have sooner or later resulted in failures. Such weak places can be removed from the cable before it is replaced in the ducts. This fact has been partly responsible for the good service record. Thus, while it cannot be said that moving the cables was the cause of the lessened expense of repairing burn-outs in the last two years, the figures do indicate that the amount of cable trouble has not increased on account of the transfer. The few burn-outs which have occurred on the reinstalled cable bear out this general idea, as they are not attributed to causes associated with reinstallation. Insulation tests also bear out the belief that the reinstalled cable is in good shape.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

EFFECT OF WAR ON 1918 CENTRAL-STATION BUSINESS

Increase in the Sales to the Smaller Factories Was Less than the Average, but to Large Factories and Residences It Was Greater

An interesting sidelight on the effect of the war on central-station business in 1918 is given by Alex Dow, president of the Detroit Edison Company, in his annual report. He said in part:

Our sales of power to the smaller factories showed less than the average increase. On the other hand, our sales of power to the larger factories, and particularly to those which promptly undertook war work, increased beyond the average for the year. Residence lighting, which is an important part of our business (175,967 residences were served in December and $3,188,512.65 earned by that service in the twelve months), likewise showed more than the year's average increase. This is due to an increase in the number of residences connected, and not to a commensurate increase in use by the average residence customer, who in 1918 was likewise asked by the government to practice economy of light and fuel.

The increase in sales of power to large factories was the result in a measure of their working night shifts and of overtime and Sunday work. The stoppage of overtime, etc., by government instructions after the signing of the armistice coincided with the removal of the Fuel Administration's restrictions on display lighting, so that there was no net resultant effect upon our December earnings, although the effect of each official order is clearly recognizable in the daily load curves.

EXPERIENCE WITH BONUS SYSTEM FOR METER READING

Found Unsatisfactory in Cleveland Owing to Human Element and Unequal Density of Meters in Different Districts

Experience with a bonus system of paying for meter reading was told of by J. T. Kermode before the recent meter conference of the Ohio Electric Light Association. As an experiment, beginning Jan. 1, 1918, a bonus system was adopted in Cleveland by which the meter readers were paid a certain rate per month with a bonus for all readings turned in in excess of an average number per day. It was considered that the bonus system would act as an incentive for men to work harder and that the amount earned would be proportionate to the amount of energy that a man would spend on his work. Unfortunately, Mr. Kermode stated, there were not sufficient data to know how just how a bonus system should be applied so that all readers would receive equal opportunities. Theoretically, a bonus system should overcome the difficulty of securing men as there are excellent opportunities to gain a good bonus. As a matter of fact, the speaker said that the bonus system caused considerable dissatisfaction for two reasons—first, the human element and, second, the unequal density of meters in different districts.

On the human-element side it was quite natural, the speaker said, for a reader to pass by individual meters in out-of-way places so that he could get to groups of meters readily accessible. Besides, it was quite common for readers to enter readings without visiting the customer's premises. But it is well known that pick-up readings or check readings due to errors are very expensive. The speaker said that the bonus system no doubt lowered the unit cost of meter reading, but the total cost of reading, pick-up readings and errors was considerably higher than the total cost of operation under a salary system.

Mr. Kermode stated that the density of meters in some districts permitted a reader to earn a fairly good bonus without much effort, while in another district the same reader could not earn a bonus no matter how hard he worked. To make conditions fairly equal, therefore, it would have been necessary to rotate the readers to different districts. Where there are a large number of districts, the readers, it was pointed out, could not become well enough acquainted in any particular district to read with sufficient speed to permit them to make a satisfactory rate of pay. Perhaps some sort of bonus can be successfully applied, Mr. Kermode stated, but he was of the opinion that it is a question if the cost of keeping track of the work performed by each man would not offset any advantage gained in the reading cost. While the unit cost of meter reading on a bonus system may be lower, the speaker was of the opinion that the total cost is higher.

WAY IN WHICH TO TACKLE AN ELECTRIC HEATING JOB

Information Which Power Salesmen Must Secure, Reasons Why It Is Needed, and Suggestions as How Best to Use It

In the determination of the amount of power required in any electric industrial heating process there is a certain amount of general information to be secured before an intelligent calculation can be made as to the kilowatt-hours of energy that will be required and the kilowatt demand necessary for a satisfactory application. It is the power salesman's job to get this information and to make use of it. Some of the points to be remembered in connection with this work which were outlined by Wirt S. Scott before the new-business committee of the Ohio Electric Light Association are presented below.

The material or work to be heated must first be considered. A given kind of material requires a definite amount of power to raise its temperature 1 deg. Fahr.,

which is referred to as specific heat and which has been determined for nearly all materials in use.

The initial maximum and final temperatures to which the material will be heated constitute the second group of factors. By initial temperature is meant the temperature at which the material is placed in the oven, furnace or container. This may or may not be room temperature, depending upon whether or not the material has previously been heated and has had an opportunity to cool off completely. The maximum temperature is that required to produce a certain chemical change or a certain result in the heating of the material. The final temperature, while often, is not necessarily the maximum temperature. A piece of work will enter a continuous oven or furnace at some initial temperature, be heated to a maximum temperature, then before leaving the oven or furnace be subjected to cooling by entering a chamber in which no heat is applied or by blowing cold air over the work. In either case a certain amount of heat which the material previously has absorbed when subjected to the full force of the heat will be given off in the oven or furnace and utilized in preheating the work entering the oven or furnace, or may be used in supplying part of the heat required to maintain the necessary temperature. In such cases, so far as heating the material is concerned, the power required will depend upon the initial and the final temperatures.

The size of the oven, furnace or container is a third consideration, owing to radiation losses.

The kind of material of which the container is made is also important because radiation losses depend upon the rapidity with which heat is conducted from the interior to the exterior. Steel produces heat 1000 times as fast as a high-grade magnesia or diatomaceous earth, hence, 1 sq.in. of steel extending from the inside to the outside of the container will conduct as much heat as 7 sq.ft. of high-grade insulation. The importance of eliminating bolts, rods, etc., extending through the container walls is apparent.

Thickness of container walls is another factor. With the heating done within the interior of the container, the rate at which the heat will flow through the walls will be inversely proportional to their thickness.

Weight of movable and immovable racks, trays or trucks within an oven or other container and their initial temperature are the sixth factor for determination. These accessories absorb heat just as much as the work does, and the power to heat them must be determined. It is desirable to have racks and trucks as light as can safely be used, also to maintain them at a temperature as high as possible by keeping them in the oven with the doors closed when not in use, or by returning them to the oven as quickly as possible.

The length of time the oven, furnace or container is out of operation between heats is a point to note. All substances absorb heat, even the walls of the oven. The amount of heat initially absorbed by an oven may easily be three or four times that required for the work. If the oven is allowed to cool off completely after each operation, an enormous amount of heat is lost in proportion to that utilized.

The eighth point is the amount of ventilation required. In many baking and drying processes a certain amount of ventilation is necessary, either to supply the oxygen required by the chemical change undergone in the heat treatment or to hasten the evaporation of moisture. The air usually enters at room temperature and is discharged at the maximum oven temperature. Seldom does the customer know the amount of ventilation he is using or the amount required to produce the best results.

The amount of moisture to be evaporated in the process is a particularly important factor. In a drying process the work may be partly saturated with water. In other instances a thin film may cover the surface of the work.

RATE INCREASES ARE MADE EASY IN HOME-RULE CITIES

Colorado Company Made Appeal First to Local Officials, After Which the Public Service Commission Acted Quickly

When the Western Light & Power Company of Boulder, Col., which furnishes service to thirty-two towns in northern Colorado and Cheyenne, Wyo., had to secure increased rates recently, it became apparent that owing to the inclusion of the "home-rule" cities of Boulder and Fort Collins in the territory the company served, special procedure would have to be employed. Home-rule cities have rate regulation under their supervision, and the Supreme Court has repeatedly handed down decisions justifying the contention of such cities denying the right of the Public Utilities Commission to fix rates for them. For that reason the company was careful that its application for the increase in rates should first be made to the city authorities in all of the towns served by the company, and their indorsement was secured before taking the matter up with the Public Service Commission.

In carrying out this campaign, D. A. Hegarty, vice-president, and C. A. Semrad, general manager of the company, appeared before the governing bodies in each of the cities and towns and explained to them carefully the situation which necessitated the increase in rates. By laying the cards face down on the table and meeting the public on a fair and open basis, they received the consent of the governing bodies of each of the towns and also the support of the newspapers throughout the territory. The applications for increases were filed simultaneously with the Public Utilities Commissions of Colorado and Wyoming, together with the resolutions approving the increase in rates from the governing bodies of the cities and towns affected and the favorable press notices.

The commissions immediately set dates for hearings on the applications fifteen days after the applications were filed. As there were no protestants against the increase at the hearings, the applications were granted, effective thirty days after filing.

In such cases it will frequently be found that the cities block rate increases not so much because the city officials believe that higher rates are not justified but because they are exceedingly jealous of their rights. In many instances in the last year it has been proved that to get the consent and backing of the local community is really simple, provided always, of course, that the utility begins at that place.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Performance of Motor-Generator Sets.—F. T. HAGUE.—The writer deals particularly with the performance of high-voltage motor-generator sets for the Chicago, Milwaukee & St. Paul Railway system. The service requirements for these sets differ from those of motor-generator sets operating at lower railway voltages in that great care must be exercised to prevent the flash-over of machines built for high voltage and large power. The necessity for improving the commutating performance of these machines involves a considerable revision of the standards of operating characteristics acceptable on low-voltage installations.—*Electric Journal*, February, 1919.

Operating Conditions in Transformer Practice.—E. G. REED.—The writer states that about 80 per cent of the distributing transformers which burn out are below 7.5 kva. in capacity, and of these about 65 per cent fail from overload, thus pointing out the necessity of properly fusing pole-line transformers. One of the very serious causes of short circuits and grounds in transformers is shown to be the presence of moisture in the oil, principally because of the fact that the oil and transformer may be stored in damp places. The trouble from moisture is noticeable principally where the voltage is higher than the usual 2300 volts on distribution systems. The author emphasizes the importance of drying out the transformers and of properly caring for the insulating oil. In addition to properly fusing transformers, the winding should be mechanically braced so that in case of heavy short circuits it will not be mechanically distorted, thus impairing the insulation.—*Electric Journal*, February, 1919.

Some Characteristics of Transformer Oils.—O. H. ESCHHOLZ.—In discussing the possibility of explosions due to high temperatures in transformer oils the writer states that the temperature required for the disintegration of the oil is very great. It follows therefore that slight differences in flash or fire points of oils used for transformers do not materially influence the ease with which such disruption is produced. No appreciable protection is therefore obtained by substituting a high-flash for a low-flash oil. He says that it has been observed that, owing to the lower vapor pressure and consequent decreased dilution of hydrogen by the less active hydrocarbon vapors, explosions in the higher flash oils are occasionally more violent. It is pointed out that every effort is being made to eliminate prolonged arcing near the oil surface and the prevention of the leakage of moisture through joints and terminal leads. There is also the danger from a low level of oil due to the uncovering of the primary terminal board.—*Electric Journal*, February, 1919.

Neutral Point on a Delta-Connected Set of Three-Phase Transformers.—E. E. STARK.—This describes a scheme of obtaining an artificial neutral on a three-phase system with a delta method of lighting distribution by using a star-wound induction motor and earthing its neutral. The regulation of the system will be governed by the capacity of the motor, which transfers energy from one phase to the other.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *New Zealand Journal of Science*, July, 1918.)

Lamps and Lighting

Measurement of Transmission Factor.— M. LUCKIESH and L. L. MELLOR.—The transmission factors have been obtained for several representative slightly diffusive glasses for two kinds of illumination—(1) for a narrow beam of light directed perpendicularly to the surface of the specimen, and (2) for uniformly diffused light reaching the specimen from all directions above its plane. It has been shown that the transmission factor of such glasses depends upon the position of the glass with respect to the light source for a narrow beam of light directed perpendicularly to the specimen. The transmission factors are generally greater when the rough surface faces the light source than when the smooth side is toward it. This difference is very apparent in the case of ribbed glasses, but it has been found to exist even for so-called "frosted" or etched glasses.—*Journal of the Franklin Institute*, November, 1918.

Generation, Transmission and Distribution

Substation Short Circuits.—R. F. GOODING.—When a substation derives its power from several parallel feeders a short circuit in the feeders may develop considerable power. This is particularly true when the feeders are in reality tie lines between two generating plants. In cases where there is very great generating capacity at either end or both ends considerable care must be exercised in the selection of reactances to limit short-circuit currents at different parts of the systems. In this article the writer deals particularly with the location of reactances for certain assumed conditions of generating equipment and feeders, reactances at the generating-station buses, reactances in the feeders and also at substations. He also deals with the magnetic forces involved in such short circuits and the necessary and mechanical constructions to return them.—*Electric Journal*, February, 1919.

New Maximum-Current Time Relay.—K. TROTT.—A new maximum cut-out with inverse time element is described which is made by Siemens & Halske, Berlin. The adjustments may be made without opening the relay circuits. The relay contacts are capable of interrupting 150 volt-amp., maximum current 3 amp., maximum pressure 220 volts direct or alternating current. On heavier overload the relay operates more rapidly than on ordinary interruptions, the law being roughly quadratic with a two-second to fifteen-second relay. The heav-

iest short circuit will not, however, operate the relay in less than three-fourths of a second to one second, when set to fifteen seconds on the time scale, unless an instantaneous release is added to operate at a predetermined overload.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, June 16, 1918.)

The "Sandwich" System of Fuel Blending.—E. W. L. NICOL.—It is said that in many important steam plants the use of bituminous coal has now been entirely eliminated by the substitution of coke. The adaptation of certain types of existing mechanical stokers to the users of coke or admixtures of coke and coal, although a difficult problem, has now been accomplished satisfactorily. The sandwich system of blending and feeding fuel to steam boiler furnaces, which incidentally permits a material increase in national wealth through by-product recovery, enjoys the distinction of having been accorded official encouragement by the coal mines department of the Board of Trade. Efficiency tests indicated about 80 per cent efficiency using a mixture of coke and coal compared to 60 per cent efficiency with coal alone.—London *Electrician*, Jan. 24, 1919.

Selecting Coal for Power-Plant Use.—ROBERT JUNE.—The writer takes up the question of the classification of coal, the question of size and the purchase of coal on the specifications. Curves are offered to show the effect on efficiency and rating of boilers of the size of screen used and also the relation between combustion space and grate area to the volatile matter in coal.—*Electrical Review*, Jan. 18, 1919.

Phase Transformation.—E. G. REED.—The following important transformer connections for phase transformations are taken up by the aid of diagrams: (1) three-phase to single-phase; (2) three-phase to two-phase; (3) two-phase to six-phase; (4) three-phase to six-phase.—*Electric Journal*, January, 1919.

Construction of Steam Boilers.—The American Society of Mechanical Engineers has just issued a bulletin covering the rules for the construction of stationary boilers and other pressure vessels, indicating allowable working pressures as well as the care and service of the same. Specifications for the construction of the boilers and related apparatus are taken up in considerable detail.—Paper read before the American Society of Mechanical Engineers, 1918.

Installations, Systems and Appliances

Electrically Driven Plate Mills.—G. E. STOLTZ.—The writer states that the three most important problems in selection of apparatus to drive a plate mill are the type of motor, the control and flywheel. These three factors are interrelated. The writer takes up specific plate-mill installations to show how the selection of apparatus was made.—*Electric Journal*, February, 1919.

The Electric Furnace in the Development of the Norwegian Iron Industry.—H. STYRI.—This is mainly a brief history of the electric furnace in the Norwegian iron industry. In referring to the Rennerfelt furnace the author states that there is very little advantage in the special feature of this furnace, namely, the arrangement of electrodes for throwing the arc against the bath, as this can be obtained with single or polyphase currents when the electrodes are placed at an angle to the charge. —*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Transactions A. E. S.*, 32, pp. 129-140, 1917.)

Elevator Code.—The elevator code issued by the Industrial Commission of Wisconsin, 1918, deals particularly with the safety of employees. The code covers the use of electric brakes and circuit breakers for high-speed elevators and also limit switches and reverse-phase relays and specifies the wiring and signal systems for electric elevators.

Wires, Wiring and Conduits

Resistance and Reactance of Commercial Steel Conductors.—H. B. DWIGHT.—In discussing the usefulness of iron and steel conductors in transmission-line service the author presents a considerable series of curves showing the change in resistance of the steel conductor with current density. The grades EBB, BB and ordinary steel grade Siemens-Martin high-strength cable are considered.—*Electric Journal*, January, 1919.

Electrophysics and Magnetism

Maximum Primary Potential in an Induction Coil.—E. TAYLOR JONES.—A discussion of whether the maximum primary potential of an induction coil should be calculated on the basis of ratio of turn or in accordance with the oscillation transformer theory which allows both the secondary and primary potential to be calculated.—London *Electrician*, Jan. 24, 1919.

Ionization and Excitation of Radiation by Electron Impact in Nitrogen.—BERGEN DAVIS and F. S. GOUCHER.—The experiments show that: Radiation can be stimulated in nitrogen molecules by electron bombardment without any appreciable ionization; the value 7.5 volts, heretofore accepted as the value of the ionizing potential, really corresponds to the least energy an electron must have in order that it may excite radiation by the bombarded molecules (there is an indication of a more intense type of radiation setting in at about 9 volts); that ionization sets in at about 18 volts. —*Physical Review*, January, 1919.

On the Mechanical and Electrodynamical Properties of the Electron.—MECH NAD SAHA.—The physics concepts of absolute independence of time and space and constancy of mass are abandoned in this investigation, which is an extension of Minkowski's method of four-dimensional analysis.—*Physical Review*, January, 1919.

A New Experimental Determination of the Brightness of a Black Body and of the Mechanical Equivalent of Light.—E. P. HYDE, W. E. FORSYTHE and F. E. CADY. —A new set of experimentally determined values of the brightness of a black body from 1700 deg. to 2600 deg. K. are given on the assumption of a temperature scale based upon Planck's equation taking the gold point as 1336 deg. K. and the constant C_2 as 14,350 μ deg. These values, as plotted in a curve obtained by a least-square solution, are compared with the relative computed values on the assumption of the visibility curve recently published by the authors. A value of 70.2 candles per square centimeter as the brightness of a black body at a temperature of 2077 deg. K. (color match with 4-watts-per-candle standard carbon lamps) is proposed tentatively as an absolute standard of light. The mechanical equivalent of light for the wave-length of maximum visibility ($\lambda = 0.566\mu$) is computed to be 0.00150 ± 0.00005 watts per lumen.—*Physical Review*, January, 1919.

Electrochemistry and Batteries

Function of Barium Sulphate in Accumulators.—O. SCARPA.—Some large batteries of accumulators constructed by one of the best known firms in Italy showed the unexpected phenomenon that their capacity, which should have remained constant for at least 200 discharges, rapidly diminished, so that after 100 discharges they had a capacity of only 40 per cent of the initial value. The author found that this had to be attributed to the physical properties of the barium sulphate mixed with the lead oxides of the negative plates in order to render the mass more porous. Microscopic observations showed that the function of the barium sulphate was to prevent the "soldering" of the lead particles of the negative paste. This purpose is more or less effected according to the physical properties of the barium sulphate.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Elettrotecnica*, Sept. 25, 1918.)

Units, Measurements and Instruments

New Method of Meter Calibration.—H. GEWECKE and W. V. KRUKOWSKI.—A new means is described for recording accurately the regular speed of rotating parts without affecting this speed in any way. The accuracy obtainable in meter tests depends primarily on the accuracy with which the time for a given number of revolutions can be determined, since there is no difficulty in measuring the corresponding load to a high degree of accuracy. The authors' arrangement uses a ray of light as transmitting medium between a mirror on the meter spindle and a selenium cell or bolometer. This method is convenient and cannot influence the meter speed in any way; the meter casing may be closed during the test. (This is frequently an important factor.) A battery is connected across one axis of a bridge and a recording chronograph across the other. The second element is connected to a seconds pendulum. The chronograph is used without relays, and a deflection is obtained once a second on one line and once per meter revolution (*i.e.*, each time the selenium cell is illuminated) on the other line.—*Science Abstracts, Section B*, Dec. 31, 1918. (Abstracted from *Elektrot. Zeits.*, Sept 5, 1918.)

Miscellaneous

Electrolysis and Its Mitigation.—E. B. ROSA and BURTON MCCOLLUM.—The Bureau of Standards, which has been engaged for some time past in a general investigation of the subject of electrolysis and its mitigation, has issued a bulletin which gives results of its investigations thus far. Some of the outstanding features of the report are given below. Remedial measures that are applicable to pipe systems should be regarded as secondary means of mitigation of electrolysis trouble, the best method being to provide proper construction and maintenance of the railway return circuit. The two most commonly applied mitigating measures are the insulation of the insulating joints and the use of pipe drainage. Both of these methods are valuable under certain conditions, the former particularly where new pipes are being laid and the latter for application to isolated pipe systems without insulating joints. Of the methods applicable to railways the most important are the adequate maintenance of track bonding, the use of a proper number and location of power houses or substations and the use of insulated negative feeders where the capacity of the rails is insufficient. Remedial measures adopted in this country have been less effective than the measures used in certain foreign countries where regulations limiting voltage drops in the negative return have been in effect. In defining the voltage limitations either the all-day average value or the average value for a period not less than one-half hour may be used. The former is preferable. The voltage drops either in the tracks or in pipes and earth may be used as the basis of fixing limitation, but in general the latter is to be preferred. Under most conditions over-all voltages in railway tracks should be limited to about 2 volts to 4 volts and the potential gradients should in general be restricted to about 0.3 volt to 0.4 volt per 1000 ft. (1.3 volts per 1000 m.) Potential wires should be installed running from some central point to selected points on the railway or pipe networks for the ready determination of these drops. Any regulations governing electrolysis mitigation should be made not alone to apply to the railway system but also to define the responsibilities of the owners of underground utilities.—*Technologic Paper No. 52*, Bureau of Standards, March, 1918.

Testing of Switch and Transformer Oils.—G. SCHENDELL.—The author describes methods of testing commercial oils. These tests are considered to be specially necessary at the present time in Germany in consequence of the fact that raw materials, often of unsuitable kind, are used in emergencies. The tests are described in various sections under the following headings: (1) The kind of oil—*i.e.*, whether resinous or mineral; (2) the color—the oil should in any case be translucent; (3) consistency; (4) mechanical impurities—the oil should contain neither straw, fibrous particles nor sand; (5) specific gravity—transformer oils between 0.85 and 0.92, switch oils between 0.88 and 0.9; (6) viscosity—on Engler's viscometer transformer oils should not be above 8 and switch oils not below 10, as compared with water at 20 deg. C. (a description of this test is given); (7) inflammability—for transformer oils the vapor should not inflame below 160 deg. C. and for switch oil not below 170 deg. C.; (8) the burning point, about 20 deg. C. higher; (9) the freezing point—in transformer oils not above —20 deg. C. and in switch oils not below —20 deg.; (10) the tendency of the oil to deposit resinous particles—this test is very important and fully described; the oil is put in a flask and heated electrically by an external spiral to 120 deg. C. for seventy hours; a strip of clean copper and a cotton bandage are suspended in the oil; the cotton bandage should not lose its strength and the oil should not become cloudy, but these conditions are very difficult with present commercial samples; (11) the oil should not tend to deposit tarry substances; (12) the volatility of the oil; (13) its water content; (14) its acid content; (15) its content of free alkali; (16) its sulphur content; (17) its resinous content; (18) its asphalt content; (19) its content of oils of an inadmissible character—mixtures of mineral and resinous oils must not be used in transformers, and it is therefore in this case necessary to determine whether any such admixture is present.—*Science Abstracts, Section B*, Nov. 30, 1918. (Abstracted from *Elekt. Zeits.*, June 20, 1918.)

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

AUTOMATIC OPERATION IS DISCUSSED AT SCHENECTADY

High Speed Favorable to Induction Generator—Synchronous Condenser Unit Automatically Responds to Voltage Conditions

The increasing tendency toward the use of attendantless stations and substations was traced by H. R. Summerhayes, C. M. Davis and L. B. Bonnett at a meeting of the Schenectady Section of the American Institute of Electrical Engineers held Feb. 28. The speakers pointed out the great saving in operating expense which is realized without sacrifice in the matter of reliability. Typical installations of automatic and remote-controlled generating plants and substations were also described with the aid of lantern slides.

Mr. Summerhayes pointed out that the wages of operators in any station, no matter what the capacity, would amount to at least $2,400 to $3,600 per year, assuming twenty-four-hour operation. On the other hand, control equipment for a single-unit automatic plant costs from $3,000 to $4,000 more than the corresponding equipment for the simplest hand-controlled plant. It is thus apparent that the saving due to automatic operation will pay for the extra equipment in about two years. While these stations require some maintenance and occasional inspection, this is a small matter compared to the saving of operators' wages. Buildings for attendants, moreover, are dispensed with, and a great saving is also effected by not heating the plants.

In the matter of reliability, which is the most important consideration in the design of attendantless stations and substations, Mr. Summerhayes stated that results had measured up to expectations. The human element is largely removed, and even the operation of synchronizing may be very satisfactorily accomplished by the use of reactance. In the case of one plant it was said that no one had entered the station for eight or ten weeks.

As to the induction generator which has been advocated for small automatic plants, Mr. Summerhayes said that for high speeds induction generators are cheaper than synchronous machines. For slow speeds, however, the induction machines are more expensive, and at medium speeds the costs of the two types may be about equal. The large magnetizing current drawn by the induction machines may be a serious consideration and may even require the use of synchronous condensers.

It was said that the General Electric Company is willing to undertake the construction of out-door generators; so there appears to be no reason why generating stations may not be built with little or no housing or heating required. He advised caution in the adoption of automatic operation for large plants.

Mr. Davis dealt particularly with the railway substations, of which there are twenty or thirty in operation. He showed the great saving in losses in substation apparatus due to automatic operation whereby machines are running at full load or are shut down. It may often prove economical to install an automatic substation where a manually operated one would not be justified.

A remote-controlled generating plant will shortly be put into service by the Ontario Power Company, California. The operation is to be performed by remote control at the main station now in service. This plant was described by the aid of slides by Mr. Bonnett, who also showed how power factor and voltage regulation had been improved at Hazel Green, Wis., by the installation of a 3000-kva. synchronous condenser which is automatically started and stopped according to voltage conditions.

In discussing the papers other speakers agreed that automatic operation offers great possibilities of development and that reliability and simplification of control and protective devices should be the present aims of designers.

In the absence of the chairman the meeting was presided over by T. A. Worcester.

Electric Shovels Dig Niagara Power Canal

Electric shovels are being used exclusively to dig this canal, which is to deliver not less than 10,000 cu.ft. (280 cu.m.) of water per second from the Welland Canal above Niagara Falls to a new 300,000-hp. hydroelectric power plant at the end of the last rapids below the falls. This canal is over 8 miles (12.8 km.) long, and to dig it the five electric shovels now in use and others to come will have to remove 19,000,000 cu.yd. (14,500,000 cu.m.) of material. One of the largest electric shovels is shown here.

MEASURES THAT FAILED WHEN CONGRESS ADJOURNED

Proposed Repeal of Daylight-Saving Law, Bill to Extend Government Control Over Wire Lines and Tests of Commodities

Among the bills which Congress did not pass before adjournment on Tuesday were several which were of direct interest to the electrical industry. Reference to failure of the water-power measure is made elsewhere in this issue.

An amendment to repeal the daylight-saving act was attached to the agricultural appropriation bill. As that bill was not passed, the daylight saving law remains in force.

The Moon bill to extend government control over telephone and telegraph systems was not passed.

Another measure, the Fletcher bill, providing for tests of qualities of commodities by the Bureau of Standards, which had been attached as an amendment to another bill, was, it appears, eliminated by the conferees of the House and Senate.

WATER-POWER BILL DIES WITH END OF CONGRESS

Act Which Had Been Approved by Conferees and Passed by House of Representatives Falls Under Senators' Filibuster

The proposed water-power legislation which has been before Congress for the six years of the present administration failed of passage when Congress expired *sine die* March 4. After lengthy debate in committee and on the floor of both houses, conferees on the part of the House and Senate agreed to report the bill favorably, and it would undoubtedly have been passed by both houses if it could have been reached on the calendar before the expiration of the Congress. The proposed legislation was passed by the House of Representatives a few days before the end of Congress by a vote of 264 to 65.

The proposed legislation failed in the Senate, however, because it became entangled in the meshes of the filibuster which was conducted by senators who are opposed to the President's policy in foreign affairs. Although there were informal assurances to senators who had charge of the proposed legislation that at least eighty votes were in favor of the measure in case it could be brought before the Senate, the bill did not obtain a hearing.

It will now be necessary for the advocates of water-power legislation, according to the Washington representative of the ELECTRICAL WORLD, to open a campaign of education for the benefit of the new members of the House of Representatives and the Senate who will take their seats in any extra session of Congress which the President may call.

Committee assignments which will have to do with water-power legislation will be altered under the organization of the coming Congress. The legislation, which has been in the hands of Democratic leaders in the House in the past, will now be committed to the hands of Republican leaders, inasmuch as the Republicans have control of the new House.

Many of the legislators on both the House and the Senate side who have been earnest students of the subject of advisable water-power legislation and have acquired a knowledge of it will not be in the new Congress.

It is too soon to say who will be in charge of water-power bills in the coming Congress, and it is not possible at this writing even to say who will be the members of the new committees which will deal with it. It is reported, however, in Washington that new bills will be introduced in both houses as soon as the expected extra session of Congress is convened.

GREAT INTEREST IN THE N. E. L. A. CONVENTION EXHIBITS

Exhibition Committee Finds that New Conditions Will Mean Either a Change in 1917 Layout or Increased Space, or Both

The exhibition committee of the National Electric Light Association announces that almost all manufacturers who were assigned space in 1917 have not only sent their acceptance for a reassignment of the same space, but in many cases have asked the committee for increased space to show their new lines or to care for the new conditions that have come up during the last two years.

The committee states this will mean either a change in the space as laid out in 1917 or increased space, or both. Consequently the committee urges the manufacturers who intend making an exhibit and who have not already applied for space to do so at once, giving details as to the amount of space required and as to what they intend exhibiting, so that some arrangement can be made to meet the new conditions and give all the manufacturers who desire it an opportunity to exhibit this year at Atlantic City during the week of the convention, beginning on May 19.

H. G. McConnaughy, secretary of the exhibition committee, can be reached at 1111 Munsey Building, Washington, D. C., or at 29 West Thirty-ninth Street, New York City.

SEEKS INFORMATION ON EARLY N. E. L. A. OFFICIALS

Association Wants to Know Addresses of Every One Who Has Served as President or Vice-President or on Executive Committee

In connection with the annual convention to be held at Atlantic City during the week beginning May 19 the National Electric Light Association is trying to get the address of every one who has served as president or vice-president or as member of the executive committee at any time in its history. Some of those who have been in the association in these capacities are not now active in the electrical industry and connection with them has been lost by the association. The ELECTRICAL WORLD has been asked to give publicity to the desire of the association. Information on the subject should be sent to T. C. Martin, executive secretary of the association, 29 West Thirty-ninth Street, New York City.

ELECTRICAL SUPPLY JOBBERS ARE TO MEET IN CONVENTION

General Gathering Will Be Held at Hot Springs, Va., Early in June—Dates for Atlantic and Central Divisions

The next general meeting of the Electrical Supply Jobbers' Association will be held at Hot Springs, Va., in the early part of June. The quarterly meeting of the Atlantic Division is to take place in New York on March 11 and that of the Central Division in Chicago on the day following.

ASSOCIATED MANUFACTURERS' ANNUAL MEETING PLANS

Meetings of Various Sections Are to Precede Annual Convention on Thursday, March 20—Schedule for the Week.

All arrangements have now been completed for the fourth annual meeting and banquet of the Associated Manufacturers of Electrical Supplies, which is to be held at Delmonico's, in New York City, on Thursday, March 20.

Charles E. Dustin, the general secretary, announces that, as in previous years, the business session will be held in the afternoon, commencing promptly at 2 o'clock, for the presentation of reports of officers and the review of the work of the several committees, including that of the international trade and the general war service committees, reports of section progress, election of governors, and for other matters of interest to the association members. The social session with banquet will be held in the grand ballroom of Delmonico's at 7.30 p.m., and for this an interesting program has been arranged with good speakers and other attractive features and a musical program by the manufacturers' chorus as last year.

Tables seating from six to twelve persons may be reserved for members and guests, and as a large attendance is assured, it is desirable that members advise Mr. Dustin at the earliest moment in order that proper seating provisions may be made. Members have the privilege of inviting guests and additional tickets will be sent on request or will be delivered at the door of the hall as desired.

Herewith is a revised schedule of meetings to be held in New York in connection with the annual meeting of the Associated Manufacturers of Electrical Supplies, from March 17 to 21. Some changes have been made since the first list was printed in the issue of the ELECTRICAL WORLD of Feb. 22.

Monday, March 17, 1919.—Industrial and Street-Lighting Fixture Section, 10 a.m.; Signaling Apparatus Section, 2 p.m.

Tuesday, March 18, 1919.—Snap-Switch Section, 10 a.m.; Molded or Formed Insulation Section, 10 a.m.; Lamp Receptacle and Socket Section, 2 p.m.; Outlet-Box Section, 2 p.m.; Attachment-Plug Section, 4 p.m.; Heating-Appliance Section, 10 a.m.; Line-Material Section, 2 p.m.; Air-Circuit-Breaker Section, 10 a.m.

Wednesday, March 19, 1919.—Panelboard and Switchboard Section, 10 a.m.; Fuse Section, 10 a.m.; Knife-Switch Section, 3 p.m.; Insulating Materials, 2 p.m.; Fan-Motor Section, 10 a.m.; Electrical Porcelain, 11:30 a.m.; joint meeting conduit industry, 10 a.m.; Rigid-Conduit Section, 10:30 a.m.; Non-metallic Conduit Section, 2 p.m.; Armored Conductor and Metallic Flexible Conduit Section, 4 p.m.

Thursday, March 20, 1919.—Board of governors, association offices, 11 a.m.; business session, Delmonico's, 2 p.m.; social session and banquet, Delmonico's, 7:30 p.m.

Friday, March 21, 1919.—Magnet wire committee of the Wire and Cable Section, association offices, 10:30 a.m.

Special attention is called to the congested condition of New York hotels at this time, and members are urged to make hotel reservations well in advance of the date of their arrival in the city.

PROPOSAL TO ABOLISH ILLINOIS COMMISSION

Hearing by Committee of the Legislature Does Not Reveal Sentiment for Abolition of Commission, but Changes Are Asked

The Senate committee on public utilities of the Illinois Legislature held a public hearing on Tuesday of this week on Senate bill No. 38 proposing to abolish the state public utilities commission.

No demand was made for the abolishment of the commission. Only one speaker, from the Greenville Commercial Club, asked that the act be repealed, and for no specific reason other than that he was opposed to that form of government. Representatives of the Chicago, Peoria and Decatur associations of commerce asked the General Assembly not to favor any measure abolishing the commission or limiting its powers in any way.

Representatives of several cities spoke in favor of the retention of the commission but urged amendments that would prevent the commission from increasing rates in excess of those provided by franchise ordinance. The Home Rule Municipal League of Illinois, representing 175 Illinois cities, asked that the commission be retained and asserted that they were fostering a bill which would be introduced on the following day amending the public utilities law by permitting cities by referendum vote to elect whether they should come under the jurisdiction of the commission. Several bills have been introduced to amend various sections of the law which would prohibit the commission from authorizing increases in rates in excess of those provided by ordinances.

The committee adjourned to meet on March 18, when a public hearing will be held on all bills affecting public utilities, which will include the bill to be introduced by the Home Rule Municipal League.

At the public hearing before the House committee on Wednesday on a similar bill no one appeared, and the matter was continued for two weeks, at which time a general hearing on all public utilities bills will be held, as well as on the Home Rule Municipal League of Illinois bill, which was introduced Wednesday. This bill provides that cities by means of ordinances, these to be voted upon and receive a majority of the votes cast at regular or special election, may go out from under the jurisdiction of the commission. It provides that they may establish a municipal utilities commission for the regulation of utilities within the corporate limits and that they may go back under the commission when the ordinance is approved by vote of the people at a regular or special election.

NO MATERIAL DIFFERENCE FROM NATIONAL PROHIBITION

Samuel Insull Expresses Belief that Public Service Company of Northern Illinois Will Not Be Affected—Past Experiences

The results of war measures on service and costs and the possible effect of national prohibition are discussed by Samuel Insull in his annual report as president of the Public Service Company of Northern Illinois for 1918.

During the year the company took on a number of large users of electric power. Mr. Insull says that this added service, together with the service of other new customers, more than offset the losses brought about by the "heatless days" during the early months of the year, by the "lightless nights" and the "daylight-saving" law.

High prices established for labor and for oil and other materials prior to the beginning of 1918, Mr. Insull adds, continued throughout the year, and substantial increases were made in freight rates. The high price of coal was also maintained, but the company's interests in coal mines proved to be a benefit effecting a considerable saving in the cost of operation.

Referring to the fact that some study has been given to the possible effect upon the business of the company of national prohibition, Mr. Insull comments as follows: "It is believed this will make no material difference in the company's income. A large proportion of the territory served by the company has been 'dry' for some time past, and it has been the experience of the company that where communities have 'gone dry' the resulting loss in certain kinds of business has been offset by increases in other lines brought about by the changed conditions."

Owing to the war the company's policy in 1918 was merely to complete additions already started to its plants but not to make other additions except as absolutely necessary. Even with this restricted policy the company was compelled to make considerable plant increases, owing to the demands for its service.

ELECTRIC FURNACES FOR THE MELTING OF BRASS

Bureau of Mines Comments on Operation of Furnace Built After Its Design by the Detroit Edison Company

In the annual report of Dr. Van H. Manning, director of the Bureau of Mines, covering the fiscal year ended June 30, 1918, reference is made to the development of electric furnaces for melting brass. An account is given of the operations of a furnace built after the bureau's design by the Detroit Edison Company, which has been described in the ELECTRICAL WORLD. Dr. Manning says:

During the fiscal year work was continued at Ithaca, N. Y., on electric brass melting. A rocking furnace of about 1300 lb. capacity, built after the bureau's design by the Detroit Edison Company under a coöperative agreement, was thoroughly tested by the bureau at the plant of the Michigan Smelting & Refining Company, Detroit. The metallurgical results were good, the metal losses of a wide range of alloys being markedly below those obtained by melting the same charges in coke-fired crucibles. The power consumption was low, comparing favorably with that of other electric brass furnaces of equal flexibility. If the metal savings be considered, the over-all cost of melting brass and bronze in the rocking furnace at the Michigan plant was not more than a third of the over-all cost shown by the coke fires under present crucible, fuel and metal prices, and the furnace can seemingly compete under pre-war conditions.

While the furnace is, of course, most efficient in continuous operation, it is particularly adapted for use at foundries that are idle at night and melt many different alloys, as it is without many of the drawbacks other types of electric furnaces show in such service.

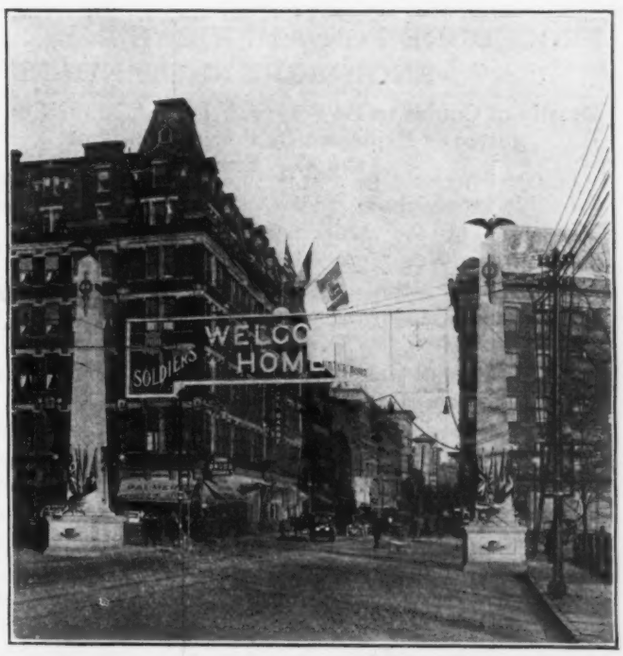
At first some difficulty was found in melting alloys high in zinc, those in which much metallic zinc is added, because zinc condensed about the electrodes, causing them to stick and break, but by suitable changes in design and operation this trouble seems to be overcome. However, the rocking furnace has not had an extended test under rolling-mill conditions, where large amounts of zinc are normally charged, but probably the furnace will work satisfactorily.

After the bureau's tests were completed, the Michigan Smelting & Refining Company put the experimental furnace into commercial use, and construction of four 1-ton furnaces for that firm was begun at once. Two other Detroit firms are each having four 1-ton furnaces built. These twelve furnaces will soon be running, and the results obtained should give fairly definite data on their possibilities.

The results of the tests have been published as Bulletin 171 of the Bureau of Mines, and a short digest of the tests has appeared in several technical journals. One firm is considering the use of a furnace of this type for calcining grains of artificial corundum.

The collection of data on the performance of other commercial electric brass furnaces has been continued, and a comprehensive report covering all types will soon be made.

Floodlamps Saved $600 in Illumination of "Welcome Home" Sign



By providing eight 200-watt floodlamps to illuminate the "Welcome Home" sign at Hartford, Conn., shown herewith about $600 was saved in comparison with the use of electric letters, and the display was not injured. The sign, facing the railroad station at Hartford, is the first object that strikes the eye of the returning service man. Four 150-watt bracket lights are provided in translucent globes to heighten the illumination.

Back to Business!

This is the way the Society for Electrical Development views it. Uncle Sam is on the job and has taken his coat off to tackle the pile of work. Optimism is in the smile and the greeting.

PROCEDURE FOR AMERICAN ENGINEERING STANDARDS

Details of Course to Be Followed by the Main Committee as Explained by President Adams of the A. I. E. E.

In his presidential address before the midwinter convention of the American Institute of Electrical Engineers in New York on Feb. 19, Prof. Comfort A. Adams outlined the proposed work of the American Engineering Standards Committee. In addition to the details printed in the ELECTRICAL WORLD of March 1, page 421, President Adams gave the following information on the procedure to be followed:

"When the development of a particular group of standards is proposed the main committee assigns the work to the appropriate organization as 'sponsor,' or, if the situation seems to indicate that more than one organization is equally interested, to these organizations as 'joint sponsors.'

"The sponsor then appoints the sectional committee subject to the approval of the main committee. The purpose of this approval is merely to assure the comprehensive representation of all the interests involved. Complete records of all interested organizations and of their standardization work and connection will be kept on file and properly classified in the office of the main committee. The main committee or its secretary will thus be able either promptly to suggest the proper representation to a sponsor on request or to approve or amplify the representation as provisionally proposed by the sponsor.

"After a group of standards has been prepared and accepted by a sectional committee it is submitted to the sponsor body for its approval and then to the main committee with a full report of its history. When approved by both the sponsor body and the main committee the standards in question become American standards.

"When the report of any sectional committee is being considered by the main committee three members of that sectional committee are invited to sit with the main committee to report, discuss and vote on the standards in question as if they were regular members of the committee. Thus each sectional committee, and therefore usually each sponsor body, will be represented on the main committee when standards in which they are interested are being discussed.

"The scrutiny of a standard by the main committee is to make sure that the proper procedure was pursued, that it was prepared by a comprehensively representative sectional committee, that the vote of acceptance was nearly enough unanimous, and that the standard is consistent with other related standards. Consideration is also given to international relations, but the main committee is not supposed to pass upon the details as it is obviously impossible for a moderate-sized workable committee to cover the details of all parts of the field.

"After approval by the main committee the standard is published by the sponsor body with the statement that it has been approved by the A. E. S. committee and labeled 'American standard' with the appropriate descriptive title."

GREAT WESTERN POWER PLAN TO SPEND $6,000,000

Outline of the Arrangement of California Company with Bankers for Raising Large Sum of Capital to Develop Its Resources

The financial plan under which the Great Western Power Company, San Francisco, as announced by President Mortimer Fleishhacker a few days ago, intends to develop its resources through the expenditure of $6,000,000, has been submitted to the California Railroad Commission in the shape of a petition asking the commission to issue the orders required to bring about the consummation of the big deal. Accompanying the petition is a copy of the agreement entered into by the power company, E. H. Rollins & Sons, Bonbright & Company and Lee, Higginson & Company, which takes care of the financial details of the development plan.

The financial plan provides for the organization of a new company, to be known as the Great Western Power Company of California, which is to take over the holdings of the Great Western Power Company, the City Electric Company and the Consolidated Electric Company. The new company plans to execute a first and refunding mortgage to secure an issue of $150,000,000 bonds, or an unlimited issue as may be determined. The immediate issue is to be for $6,000,000 of series A six per cent bonds, dated March 1, 1919, due on March 1, 1949. The bonds are to be sold at 88, and

$1,650,000 of the total of $5,280,000 is to be advanced to the Great Western Power Company and by that company expended in carrying out the developments and extensions planned; $350,000 is to discharge indebtedness of the new company to the Bankers' Trust Company, and the balance is for the purchase and acquirement of necessary lands and rights in the Butte Valley, the scene of the greatest construction program. There is also provision for the immediate issue of $1,500,000 of 7 per cent cumulative preferred stock of the new company, Bonbright & Company having agreed to take the entire issue at 90, delivery to be made within two years in five installments of $300,000 each.

The construction program calls for the immediate construction of a hydroelectric plant, to be known as the "Caribou plant," on the north fork of the Feather River, a development designed to enable the power company to meet demands for power and energy and to minimize the danger of power shortage.

The plant is to be erected in the main canyon of the North Fork about 6 miles (9.6 km.) from Belden station on the transcontinental line of the Western Pacific Railway. The spillway at Big Meadows Dam (Lake Almanor) will be raised 9 ft. (2.7 m.) and the capacity of the reservoir thereby increased by 80,000 acre-feet (9830 hect.-m.), making it 380,000 acre-feet (46,700 hect.-m.). Water from the lake will be diverted through a large intake tower and through a concrete-lined tunnel, 7 ft. (2.1 m.) in inside diameter and 2 miles (3.2 km.) in length, to the Butte Valley watershed, and there spilled into the channel of Butte Creek, where, together with the natural waters of Butte Creek, it will flow down the valley to a small dam at the lower end of the canyon, which will serve as the plant's forebay. A second tower will receive the waters at this point, which, after passing through a series of three tunnels of an inside diameter of 9 ft. (2.7 m.) and an aggregate length of about 2 miles, 1400 ft. (420 m.) of which has already been excavated, will drop to the power house below through steel penstocks embedded in concrete in solid rock tunnels.

The power plant will consist of two 20,000-kw. units, together with necessary electrical apparatus for switching and stepping up the electrical energy to the transmission voltage, all housed in a monolithic reinforced-concrete structure. Ultimately the plant will be increased to a capacity of 136,000 kw.

From the power house a 150,000-volt steel-tower transmission line will convey the power to Big Bend, and thence to Valona substation, a distribution network center on the shore of San Francisco Bay south of Carquinez Straits.

A 9-mile (14-km.) standard-gage railroad will be built from the Western Pacific Railway to the plant site so that machinery and material may be economically handled. The lands, water rights and the major part of the easements necessary to the consummation of the project are already in hand, being the property of the Great Western Power Company. It is thought that the plan can be put in operation within from one to two years, according to the speed at which the work is pushed.

The cost of the entire project, including the transmission line, is estimated to amount to something over $6,000,000.

GOVERNMENT TRAINING OF DISABLED SOLDIERS

Electrical Training Offered Free by Federal Board for Vocational Education to Disabled Discharged Men of the Forces

The following information is made public by the Federal Board for Vocational Education, Washington, D. C.:

Electricity in all its branches is proving very attractive to the disabled soldiers, sailors and marines who are taking the free trade and professional education placed at their disposal by the United States government through the Federal Board for Vocational Education. Men who had a smattering of electrical information before the war are now given the opportunity to perfect themselves and become really skilled in the particular branches which they have chosen. This training embraces both practical and theoretical work, such as may be obtained in the Massachusetts Institute of Technology, the Case School of Applied Science, the Georgia School of Technology and the Alabama Agricultural and Mechanical College, in addition to practical training with the General Electric Company and other concerns and in plants of some of the great power companies.

One development of the war is the opening of a brand new and well-paid skilled occupation—that of oxy-acetylene welding. This and the general handling of the wonderful oxy-acetylene torch in other lines afford opportunities for many men disabled by war. The course is one of the most popular among the 400 trades, occupations and callings in which free education is offered. Competent handlers of the oxy-acetylene torch are readily hired at good wages by railway shops, electric street railways, in shipyards, in the automobile industry and in repair garages, for gas, sewer and water-pipe work, in sheet-metal work and in metal-furniture making, in foundries and general machine repair shops.

A disabled soldier of thirty whose previous occupation required the handling of logs and heavy machinery, but who had read books on engines and electricity, is taking a course in electrical station operation, because an injury to his back from shrapnel makes heavy work impossible. The government will give any handicapped man who needs and desires it the kind of training indicated above, provided, of course, that his claims are reasonable and that his previous training and the nature of his handicap are such as to make further training profitable. Men taking the courses are, if unmarried, supported by an allowance of $65 per month from the federal board. More is given if the man has dependents. There is no set time in which a course must be finished. The sole criterion is the ability of the man to "carry on" under commercial conditions. If it is a wage-earning branch of the trade he is qualifying for, a position is ready for him when he is ready for it, the placement division of the board having arranged for his employment. The Federal Board for Vocational Education is anxious to hear from any war-disabled soldiers who are interested in this free training provided by the government, not as a charity but as a matter of justice to disabled men who have been impaired in the nation's service.

CONTEST OVER TELEPHONE RATES IN THE OHIO COURTS

Injunction Issued in Columbus Against New Schedule Announced by the Postmaster-General—Finding of the Court

Judge E. B. Kinkead of the Franklin County Common Pleas Court, Columbus, Ohio, issued a permanent injunction against the Ohio State Telephone Company on Feb. 27 to prevent it from putting into force the rates announced by Postmaster-General Burleson recently. A temporary restraining order was issued by Judge Kinkead some weeks ago. J. E. Todd, counsel for the company, stated that the case will be carried to a higher court. General Manager Gould Williams said that the new rates had never been given a fair trial in Ohio, although they have been used by some of the Bell companies.

Suits are now pending in Ohio against the American Telephone & Telegraph Company and the Cincinnati & Suburban Bell Telephone Company. All of them were filed by Attorney-General Price in behalf of the Public Utilities Commission.

The injunction is based on the ground that the announced rates are not such an act of control as was contemplated by the federal law which gave control of the telephone lines to the President for war purposes and that the federal statute specifically provides that the federal control exercised shall not operate against state police regulations, which include, according to Judge Kinkead, the Ohio public utilities act prohibiting the increase of telephone rates without receiving the consent of the Public Utilities Commission of the state.

The court holds that the federal act gave the President control of the lines for war purposes only and that Congress did not contemplate such control as would allow the change of rates or anything else that would affect the use of the lines by the public. Until peace is proclaimed that control still exists, but only so far as the lines are used for distinctly war purposes. The court said he had scant patience with fictitious questions based upon the laws enacted for the purpose of aiding the President in transacting the business of the war. Such control as was given is only temporary and was not given to allow sweeping changes that would affect the private business of the companies. It has not been shown that the rates were promulgated to raise funds for war purposes, and he does not believe that the federal law was intended to give the companies power to override the state laws.

According to Attorney-General John G. Price of Ohio, federal and state officials throughout the country will coöperate to secure from the United States Supreme Court a decision as to whether Postmaster-General A. S. Burleson acted according to law when he promulgated an order for a change in long-distance telephone rates, which, it is claimed, has resulted in an increase in most instances. Mr. Price recently spent some time in Washington in conference with the authorities.

Suits bearing upon this order have been filed in a number of states, but it has not been determined which one of them will be carried to the United States Supreme Court.

Census Bureau Report of Electric Light and Power Stations—1917

Preliminary figures, published herewith, of the forthcoming quinquennial report on the central electric light and power stations of several states have been given out by Director S. L. Rogers of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of Eugene F. Hartley.

The statistics cover both commercial and municipal plants. They do not cover electrical plants operated by factories, hotels, etc., which generate for their own consumption, those operated by the federal government and state institutions, and those that were idle or in course of construction.

	West Virginia			Oklahoma			Massachusetts		
	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917
Number of establishments	72	58	.....	201	130	54.6	120	117	2.6
Commercial	63	52	.....	95	67	41.8	81	87	—6.9
Municipal	9	6	.....	106	63	68.3	39	30	30.0
Income	†$3,583,492	†$1,167,583	206.9	‡$4,306,782	‡$2,357,950	82.6	¶$30,392,893	¶$16,306,909	86.4
Electric service	$3,508,995	$1,148,089	205.6	4,212,933	2,287,329	84.2	$29,636,879	$15,996,463	85.3
All other	$74,497	$19,494	282.2	93,849	70,621	32.9	$756,014	$310,446	143.5
Total expenses, including salaries and wages	$2,975,345	$897,843	231.4	$3,541,443	$1,888,706	87.5	$23,577,844	$11,651,739	102.4
Number of persons employed	753	439	71.5	1,112	785	41.6	5,482	3,954	38.6
Salaries and wages	$675,121	$255,471	164.3	$885,880	$581,580	52.3	$4,557,883	$2,981,043	52.9
Total horsepower	130,693	43,185	202.6	80,997	53,922	50.2	680,485	350,780	94.0
Steam engines:									
Number	84	88	.....	223	194	14.9	239	270	—11.5
Horsepower	114,094	34,064	234.9	66,769	45,821	45.7	55,212	323,128	71.8
Internal-combustion engines:									
Number	32	24	.....	133	38	250.0	24	22	9.1
Horsepower	10,100	3,085	227.4	12,860	5,966	115.6	6,287	3,172	98.2
Waterwheels:									
Number	15	14	.....	5	7	—28.6	78	58	34.5
Horsepower	6,499	6,036	7.7	1,368	2,135	—35.9	118,986	24,480	386.1
Kilowatt capacity of dynamos	103,611	29,772	248.0	57,783	38,301	50.9	478,933	252,732	89.5
Output of stations, kilowatt-hours	204,107,945	42,344,796	382.0	100,737,632	48,824,097	106.3	937,124,653	386,254,294	142.6
Stationary motors served:									
Number	3,883	1,279	203.6	6,375	3,470	83.7	65,218	37,191	75.4
Horsepower	98,573	22,925	330.0	61,268	23,056	165.7	446,025	228,868	94.9
Number of street lamps:									
Arc	2,151	2,096	2.6	1,925	3,303	—41.7	16,375	17,601	—7.0
Incandescent, etc	5,996	2,922	105.2	13,763	8,334	65.1	100,394	67,372	49.0

* A minus sign (—) denotes decrease. Percentages omitted where base is less than 100.
† Exclusive of $713,008 in 1917, and $386,598 in 1912, reported by electric railway companies as income from sale of electric energy.
‡ Exclusive of $11,669 in 1917 and $130,096 in 1912, reported by street and electric railway companies as income from sale of electric energy.
¶ Exclusive of $578,283 in 1917 and $396,124 in 1912, reported by street and electric railway companies as income from sale of electric energy.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

N. E. L. A., Manila Section.—The Manila Section of the National Electric Light Association will have C. H. Van Hoven as its president and J. G. Hess, Jr., as its secretary for the ensuing year.

Jovian Club of Cincinnati.—Through its war labor committee the Jovian Club of Cincinnati has arranged a campaign for the reëmployment of all soldiers, sailors and marines who were engaged in electrical work as fast as they return home.

New Mexico Electrical Association.—D. W. Morgan of Las Cruces was elected president and Charles E. Twogood of Albuquerque was elected secretary-treasurer of the New Mexico Electrical Association for the coming year at the meeting reported in the ELECTRICAL WORLD for March 1.

American Association of Engineers.—A. A. Mathews has been elected president and S. J. Treadway secretary of the Dallas Chapter, American Association of Engineers. The Pittsburgh Chapter of this association also announces its officers for the coming year, they being C. K. Harvey, president, and H. Gellin, secretary.

Association of Operating Engineers of the Thomas A. Edison Interests.—An address was given to the Association of Operating Engineers of the Thomas A. Edison interests on Feb. 19 by Prof. L. A. Belding, Stevens Institute of Technology, his subject being "The Use of Alternating Current in Manufacturing Processes."

Engineers at Akron to Organize.—Dean Fred Ayer of the engineering school of the University of Akron is at the head of a movement to organize a general association of engineers which will absorb the Jovian League, the Aëronautical Engineers' Society, the Mechanical Engineers' Society and all other organizations, including both local societies and branches of national organizations.

Electrical Supply Jobbers' Association, Pacific Division.—The annual meeting of this division was held at Del Monte, Cal., Feb. 13, 14 and 15. R. M. Alvord, General Electric Company, presented as a topic for discussion the desirability of making an analysis of electrical jobbing methods for the purpose of reducing expense of operation and increasing economy generally A paper was also read by W. M. Deming, publisher of the *Journal of Electricity*, on the subject of the probable trend of prices and the business outlook. T. E. Bibbins, president Pacific States Electric Company, was elected as chairman of the Pacific Division of the association for 1919

A. S. M. E., New York Section.—"The Application of Electrical Control to Gate Valves" was the subject of a paper presented before the society by Peter P. Dean, engineer of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., in which he emphasized the point that electricity for this purpose is so reliable that it may often eliminate a loss of life in handling superheated steam lines.

Illinois Association of Electrical Contractor-Dealers.—John F. Gilchrist, E. W. Lloyd and W. A. Durgin, all of the Commonwealth Edison Company, were among the speakers at the annual convention of the Illinois Association of Electrical Contractor-Dealers held on Feb. 14 and 15 in Chicago, their message being that the Commonwealth Edison Company stood ready to discuss with a committee from the contractor-dealers any of the company's policies which might be construed as harmful to the local electrical retail trade. Other speakers at the convention were George A. Hughes, president of the Edison Electric Appliance Company; C. E. Brown, Central Electric Company; John R. Smith, Electrical Estimators' Association of Chicago; Louis Kalischer, Brooklyn, N. Y.; Fred R. Farmer, Beardslee Chandelier Manufacturing Company; Albert Uhl, Henry Newguard Company; A. L. Swanson, Evansville, Ind., and L. T. Block, St. Louis. The officers elected for the coming year are R. W. Poelma, chairman, and N. M. Blumenthal, secretary.

American Institute of Electrical Engineers

Cleveland Section.—Harry L. Bradley of the Allen-Bradley Company, Milwaukee, presented a paper on "The Application of Graphite to Battery Charging and Motor Control" on Feb. 17.

Toronto Section.—J. F. Heffron presented a paper entitled "Recent Advances in Illumination" at the Jan. 31 meeting, and Hugo J. Lund of the Canadian General Electric Company read one on "The Manufacture of Electric Porcelain" at the Feb. 7 meeting.

Madison Section.—At the Feb. 11 meeting Prof. E. M. Terry gave an outline of the uses of tubes in radio-telephony. Connections were made so that the audience heard the Arlington station send out the time and the weather reports and also listened to music in another part of the building.

Erie Section.—Members of the Engineers' Society of Northwestern Pennsylvania and the Erie Sections of the American Society of Mechanical Engineers and the A. I. E. E. heard Prof. Comfort A. Adams on Feb. 11 speak on "Electric Welding in Shipbuilding." James Burke of the Burke Electric Company, Frank Geary, builder of the first electrically welded tugboat, and Herman Lemp of the General Electric Company also spoke.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Service Charge.—The Ohio Public Utilities Commission has denied the application of the Toledo Railways & Light Company for permission to collect a service charge of 50 cents per month from each consumer. The City Council has, by ordinance, fixed a rate of 7 cents per kilowatt-hour, which took effect on Feb. 6. The commission suggested that the company take an appeal from this ordinance, if it is not satisfied with the rate, and this course will probably be followed.

Discounts and Minimum Charges.—In a decision allowing the Public Electric Light Company, St. Albans, to make a horizontal increase of 10 per cent in its electric rates, the Vermont Public Service Commission holds that a single rate of discounts for payment of bills within a specified date is preferable to two rates of discount varying with specified lengths of time within which bills may be paid. It also held that a utility company should not be allowed to make an additional minimum charge to consumers having two meters where the second meter is required in order to enable consumers to obtain the needed service at the lowest price made by the company's classification of service.

Justifying Rate Increase.—The Maine Public Utilities Commission has announced its policy in regard to higher rates sought by the Milo Electric Light & Power Company, substantially as follows: "Our engineering and accounting departments have been engaged in this investigation, prosecuting it as fast as circumstances would permit. They have not yet been able to complete the work; and, while it was understood and agreed by both parties that this should be done, neither their inability to complete it nor this agreement as to procedure relieves the proponent from the burden of justifying the increases. This has not been done within the suspension period originally fixed. Neither party should suffer from this fault, because the procedure was agreed upon. Upon the other hand, the rates should not become effective until such proof is presented. The situation presented to the commission the alternative of extending the suspension period or of disallowing the proposed rates for lack of proof sustaining their reasonableness, saving to the proponent the right to prosecute its case further without prejudice. The latter course appears to be preferable under the circumstances, and it will be so ordered. A date will be fixed as soon as the above reports are completed on which the parties may be heard further if they desire."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Storm Damages Wire System at Cincinnati.—A 44-mile gale, accompanied by rain, swept over Cincinnati (Ohio) on the evening of Feb. 28, and many of the transmission lines were put out of service for four or five hours. Poles blown down caused the greater part of the damage. Walnut Hills, the eastern and northeastern sections of the city were in darkness for some time and cars stopped running.

Engineers of Illinois State Institutions Meet.—Since the recent consolidation, effected by the present Governor of Illinois under the civil administrative code, the various state institutions are tied together closely under common supervision. All mechanical work, including operation, maintenance, repair and new construction, is subject to the supervision of Fred J. Postel, a state officer, bearing the title of supervising engineer. The chief engineers of the various institutions having charge of mechanical work are now in a way units of the organization, and as there are many operating features of common interest to these men, they were called together at state expense to hold their first annual convention at Dunning, one of the state's largest institutions, on Feb. 14 and 15. The program consisted of addresses by prominent engineers, including Joseph Harrington, Prof. H. H. Stoek and Prof. S. S Parr of the University of Illinois. The discussion of boiler-room problems which the engineers meet in their daily work was continued at a lively pace throughout the two days.

J. E. Aldred Lectures at Johns Hopkins.—The department of engineering of Johns Hopkins University, Baltimore, has announced the complete list of the J. E. Aldred lectures on engineering practice for this year. The course of lectures is one feature of a general plan, made possible by Mr. Aldred's gift, for furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. Three lectures each will be given on the general subjects, civil, electrical and mechanical engineering. They will be given on Wednesday afternoons at 4.45 o'clock in the auditorium of the Mechanical and Electrical Engineering Building of the university, at Homewood. The lectures are open to the general public, and tickets of admission are not required. The complete program, including the lectures already given, follows: Feb. 5, "The Public Service Electric Power System," Percy H. Thomas; March 5, "The Human Element in the Machine Shop," James Hartness; March 12, "Berthing and repair Docks for Shipping," Rear Admiral Frederic R. Harris, U. S. N., retired; March 26, "Safety from the Standpoint of Industrial Efficiency," C. W. Price; April 2, "The Modern Steel Freight Ship," D D. Thomas; April 9, "The Duties of the Young Engineer in the Construction of a Hydroelectric Plant," H. S. Slocum: April 30, "The Production of 50 per Cent Ferro-Silicon in the Electric Furnace," P. H. Falter; May 7, "Ore Docks on the Great Lakes," John E. Greiner; May 14, "Disturbing Currents in Telephone Systems," John B. Taylor.

Test for Municipal Operation.—Light Commissioner W. E. Davis of Cleveland, Ohio, states that the new addition to the municipal light plant will begin operation in June of this year. The delay in construction caused by labor shortage and lack of materials, he said, cost the city $300,000. This added to the cost of construction will bring the outlay for the plant to about $2,000,000, instead of $1,750,000 as originally estimated. As soon as the plant extension is opened there will be fixed charges of 15 per cent., or $300,000 per year, including interest, depreciation and sinking-fund charges, which will become part of the operating expenses. A considerable period will be required to acquire business and collect on it to pay the additional charges, he said, and this will be the crucial time for the municipal plant.

Electrically Operated Dredges Increase Load of California Company.—Work has been begun on the new substation of the Southern Sierras Power Company at the Hanlon heading. This station is to be within a few hundred yards of the international boundary line, on the California side, and service will be given by it to the Imperial Irrigation District for the operation of dredges. These dredges are used in freeing the main canal of the silt that is carried in such quantities by the waters of the Colorado River. Electrical energy has been furnished from a temporary substation for several months, and two new dredges, each with a total connected load of 850 hp., have been in service for some time. The irrigation district is changing over a third dredge from steam to electric drive and will within a short time put a fourth one in operation which will increase the total connected dredge load to 2750 hp. An additional 500-hp. motor will be installed this spring for driving a centrifugal pump at the headgates. This irrigation project supplies water to some 600,000 acres in Imperial Valley through a main canal into which water from the Colorado River is diverted by the Hanlon heading. The Southern Sierras is installing an additional 900 kva. in transformer capacity, which will bring the station capacity up to 2400 kva. This substation is at a point 455 miles from the center of generation on Bishop Creek, and voltage regulation is effected by means of synchronous-condensers which are installed at intermediate points.

Union Gas & Electric Company Can Supply Hamilton.—President W. W. Freeman of the Union Gas & Electric Company, Cincinnati, Ohio, recently announced that his company is now in position to furnish service to Hamilton in case that city desires it. A committee was recently appointed by Mayor Smith of Hamilton to look into the matter. The Ohio Gas & Electric Company, which has been supplying Hamilton utilities, owns a transmission line between Cincinnati and Hamilton. The power was furnished by the Union Gas & Electric Company.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contracts Required for Municipal Plants.—A city is not liable for coal furnished under a written order from the superintendent of a light and power plant operated by the city, as there is no contract such as the law requires, the Springfield (Mo.) Court of Appeals held (208 S.W. 109).

City Ordinance Application.—Where a city ordinance made the price of gas a certain amount, with the privilege of a 10 per cent discount if paid before a certain date, a later ordinance, omitting the privilege of a discount and providing an additional 10 per cent for delay in payment, could not be applied retrospectively under law, even though the discount feature were considered a mere inchoate right or privilege, according to the Civil Court of Appeals of Texas (208 S.W. 239). A city ordinance which granted a gas company the right to a minimum charge on meters could not, under the law, take effect for the month in the middle of which the ordinance went into effect.

Rates Fixed by Legislature Cannot Be Changed by Commission.—When the Legislature has fixed the maximum price for gas, the Public Service Commission has no power to allow the charging of a greater rate, even though the statutory rate be confiscatory, according to the Supreme Court of New York, Kings County (173 N. Y. S. 789). Though enforcement of a rate for gas had been enjoined pending trial and the company was charging the rate it had been charging prior to the enactment of the statute, the Public Service Commission may, under the Public Service Commissions law, require the gas company to file a schedule of its rates, the filing of the schedule giving the commission no greater control over the rate than it would have possessed had none been filed.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Paul Cloke has been elected to a professorship in electrical engineering at the University of Arizona, Tucson.

Andrew Gaul of Bergen County, N. J., has been appointed a member of the State Board of Public Utility Commissioners.

J. Hall Truman, Jr., has been appointed district superintendent of the Ohio Service Company at New Philadelphia, Ohio.

Ernst Hutchens, formerly city electrician of Bluffton, Ind., has become superintendent of the Linn Grove Light & Power Company.

Harry L. Knight has been appointed to succeed Ralph W. Donges as a member of the Board of Public Utility Commissioners in the State of New Jersey.

C. C. Slater has been appointed general manager and general superintendent of the Columbus Railway, Power & Light Company, Columbus, Ohio. Mr. Slater was in charge of the construction work of the old Public Service Company and acted as its general superintendent for eight years. In recent years he has been interested in the coal-mining business.

R. J. Dearborn has recently withdrawn from the patent-law firm of Marshall & Dearborn, New York City, to take up work with the Texas Company as patent attorney. Mr. Dearborn was associated with Mr. Marshall for six years. Prior to that he was connected with the Westinghouse Electric & Manufacturing Company for nine years, during the last seven of which he was engaged as one of the assistant attorneys in the patent department.

Thomas F. Kelly, commercial manager of the Dayton (Ohio) Power & Light Company, has resigned to become sales manager for the Dominion of Canada for the Hoover Suction Sweeper company. Mr. Kelly prior to going to Dayton nine years ago was contract agent for the Dominion Power & Transmission Company of Hamilton, Ontario, with which company he began in 1900 as a junior clerk. Mr. Kelly is particularly well known among central-station men for his committee work in the Commercial Section, N. E. L. A., being at the time of his resignation a member of the executive committee of the section and chairman of the executive committee of the lighting sales bureau. In both Hamilton and Dayton Mr. Kelly was active in civic work.

Hartley Le H. Smith, former chief of the testing bureau of the Brooklyn (N. Y.) Rapid Transit System, has resigned to take charge of the steam engineering department of the New England Power Company, Worcester, Mass. Mr. Smith was with the Brooklyn company for more than sixteen years. The testing bureau was organized soon after he joined the staff and under his direction has grown to be a large department with mechanical, electrical and chemical subdivisions. He secured his elementary education in Camden, N. J., later attending Drexel Institute in Philadelphia. Upon graduation he became connected with the Camden & Suburban Railway, where he spent one and one-half years as assistant electrical engineer, resigning to join the Brooklyn company's staff.

Edward B. Meyer, assistant to the chief engineer Public Service Electric Company of New Jersey, who was recently appointed chairman of the committee on transmission and distribution of the American Institute of Electrical Engineers, has been a member of the National Electric Light Association committee on underground construction for the past eight years, the last part of that period as chairman.

E. B. MEYER

He is also a member of the sub-committee on wires and cables of the Institute. This committee was appointed at the request of the chief of the Bureau of Steam Engineering to assist the Navy Department in the solution of problems relating to wire cables with special reference to the high-tension cable to be used on the new electrically driven warships. Mr. Meyer was born in Newark, N. J., in 1882, where he received his early education. Upon graduation in 1903 from Pratt Institute, Brooklyn, he entered the engineering department of the Public Service Electric Company, and three years later he became field engineer in charge of installation of underground transmission and distribution systems. In 1909 he became assistant engineer, and in 1912 assistant to chief engineer, which position he now holds. Mr. Meyer has written for the engineering press and is the author of a book on "Underground Transmission and Distribution."

Brig.-Gen. George H. Harries, the first American officer in Berlin as the American member of the Inter-Allied Commission on the Repatriation of Prisoners of War, formerly vice-president of H. M. Byllesby & Company, has finished the task of evacuating not only American prisoners but those of Greece, Serbia and Rumania as well. For some weeks he has been engaged in a much greater and more difficult task, namely, the return to non-Bolshevik Russia of the 600,000 to 700,000 nationals of that country.

Charles E. Michel, who has been appointed sales manager of the Union Electric Light & Power Company, St. Louis, Mo., joined the Union company organization in 1907 as manager of the electric vehicle department. That department was later combined with the office sales department under his management. Finally those two departments were consolidated with the sales department and he now presides over them all. He is a graduate of the engineering department of the Virginia Military Institute and is lieutenant-colonel of the First Regiment of Infantry, Provisional National Guards of Missouri.

J. A. Whitlow, who was recently appointed general manager of the Pine Bluff (Ark.) Company, was previously administrative engineer and state director of conservation for the United States Fuel Administration of Missouri, while at the same time he was chief of the department of gas, electricity, heat and water of the Public Service Commission of Missouri. Mr. Whitlow was three and one-half years with the commission, three years chief engineer for the Board of Education, St. Louis, Mo., and three years with the Union Electric Light & Power Company, St. Louis, Mo. He is a graduate electrical engineer of the University of Missouri, and has also been assistant professor of electrical engineering at his alma mater.

Obituary

Alva W. Bernard, local manager of the Western Light & Power Company at Boulder, Col., died on Feb. 23 from pneumonia following an attack of influenza. Mr. Bernard was born in Leadville, Col., July 16, 1884, and was educated in Boulder, entering the employ of the Western Light & Power Company in 1904 as electrician. He rose to various positions and finally to the post of local manager at Boulder, which position he had held since 1917.

James E. Cole, wire commissioner of Boston, Mass., died at Needham Feb. 22. He was born at Roxbury, Mass., fifty-seven years ago and was educated in the local schools. Mr. Cole had been commissioner of wires since the administration of Mayor Hibbard, having been reappointed by each successive mayor. He was highly regarded in electrical and insurance circles, and his knowledge of the National Electric Code was of a really professional description.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

SOME SALIENT FEATURES OF FARM-LIGHTING MARKET

Distribution Program of Prominent Producers Calls for Agents Who Virtually Form a New Set of Electric Supply Jobbers

An interesting development in the electric supply jobbing field is taking place in connection with the farm-lighting market. This market has grown to a considerable size in the last two or three years, and the development of special 32-volt appliances has opened up a line of goods with a rapidly growing demand.

There are a number of manufacturers of farm-lighting plants each with a more or less different distribution policy. One plant is being distributed exclusively through electrical contractors. Other plants are being placed in customers' hands through local implement dealers. The electrical jobber is acting as agent in many cases. There are a couple of the largest producers, however, who are using their own agents exclusively. In one case the agent handles everything even to the wiring of the customer's premises, while in the other case this work is left to the local electrical contractor. In both instances, however, these agents are virtually becoming electrical supply jobbers, specializing on 32-volt installations. They are carrying more and more of an electrical stock, such as socket devices, motors, lamps, batteries, repair parts, etc. In fact, this has really become a necessity in order to get good agents to handle the proposition. There is not sufficient profit, it has been claimed, to entice one to distribute lighting plants alone. Once a plant is sold, however, there is at once provided a new outlet for the sale of additional labor-saving equipment.

CURRENT HIGH PRICES UNFAVORABLE TO FIXED LIST

General Electric Company Doubles List on Wiring Devices in Order to Get Away From Unsatisfactory Condition

Up to the time that the prices of materials began to skyrocket it was very satisfactory to make a fixed list price and to change discounts as market conditions warranted. Catalogs on this basis did not have to be changed every time the price changed. It was simply necessary to change the discount sheet.

Lately, however, the margin between list and net has become very small, and not infrequently the net selling price is greater than the list price. A good deal of confusion has been created, and some concerns have gone so far as to abolish the practice of quoting on a list basis and now quote on a net basis altogether.

This week an announcement was made by the General Electric Company relative to a new price schedule affecting its entire line of wiring devices, except inclosed fuses and some similar material, effective March 1, whereby all lists are doubled.

"During the active period of the war," the statement reads, "when costs advanced very rapidly, the easiest way to accomplish each advance in prices was to reduce discounts. This resulted in a most unsatisfactory method of figuring net prices on many lines, necessitating as it did in many instances selling wiring devices on a list-plus basis. There is no indication that costs will be sufficiently reduced for some time to come to warrant the continuing of this present unsatisfactory method of pricing.

"The company decided that the only way immediately to remedy this, without making present catalogs obsolete, was to declare practically all list prices doubled and establish a new schedule of discounts from these doubled lists which gives the same net prices as are now in effect."

BETTER MARKETING OF CONTROL EQUIPMENT NEEDED

Hasty Decisions in Cases Where War Demands Required Quick Installations Have Caused No End of Dissatisfaction

Although controlling apparatus has been widely standardized for some time, it is important that adequate engineering consideration be given to motor-driving problems involving severe service conditions. Perfunctory selection of equipment may lead to trouble. Under the stress of war conditions many installations were hastily made. Cost was of little consequence and early industrial production of the utmost importance. The specification or selection of controlling equipment ill adapted to the required service was necessary in some cases in order that the motors could be set at work quickly. These hasty installations have led in some instances to expensive replacements of motors, sweeping rearrangements of drives, interrupted production, damages to the original layout of machinery, and dissatisfaction with products substitutes for which would have given admirable service had there been a suitable preliminary engineering study. In addition, the cancellation of orders, throwing of motors upon the second-hand market after but a few weeks' service, loss of time in making betterments and an increased cost of plant beyond necessary limits would have been avoided or at least reduced.

Deliveries of control apparatus by the manufacturers of better reputation are so good now that there is little excuse for hasty work in motor applications. Even during the war in some sections of the country controller deliveries compared favorably with those promised on motors, but sometimes the equipment put in was unequal to the conditions. Vibration and rough handling by very unskilled labor led to disaster, and sometimes the pressure upon the motor users to get out war material was so great that the controlling apparatus could not be kept in order sufficiently to permit the use of the original motor installation.

One case occurred where 500 5-hp. induction motors were installed for turret-lathe individual driving. The labor available was so poor in quality that fuses were blown literally by the bushel. The original control equipment would not "stand the gaff," and when the employees replaced the fuses with solid copper wire the situation showed no improvement. Designs were prepared for an automatic control which when tested promised to solve the problem; but it was impossible to get suitable deliveries and so great was the importance of the plant output from the military standpoint that it became necessary to substitute eight 50-hp. motors for the 500 units. This was a war-time experience, but it points a moral in the careful selection of control for future installations under conditions of peace operation. More analysis of the mechanical fitness of controllers for duty under conditions of severe vibration, moisture, poor ventilation, neglected supervision, deferred

inspection and postponed maintenance efforts will save many an installation from getting an undeserved "black eye" from some minor but none the less important feature which good sales engineering would avoid.

In the machinery trade as a whole, no less than in electrical circles, the failure to pay sufficient attention to the selection of auxiliary appliances is felt to be a prolific cause of dissatisfaction, and forward-looking observers expect a reformation in this practice. Repeat orders unquestionably have been canceled because of inadequate controller selection after earlier installations of different control gave excellent results. Certainly a closer coöperation is desirable between distributers of machinery, motors and control equipment than has often heretofore been feasible.

METAL MARKET SITUATION

War Department Not to Dump Surplus Copper on the Market at Low Price

There has been much interest shown in the policy of the War Department as to the method of disposal of its stock of copper. Articles appearing in newspapers have stated that this surplus stock would be sold back to the producers at 11 cents to 12 cents per pound. The War Department on Feb. 28 issued a statement refuting these press articles and upholding a policy of selling, through the director of sales, surplus property at market prices, allowing the trade only the actual cost of handling. The government surplus is about 14 per cent of the total copper supply of the country. Electrolytic dropped ½ cent over last week to 14.87½ cents, and London standard is reported off £1. Large producers have made sales at 15 cents and small producers have gone to 14.75 cents.

Estimated sales of refined copper for the past week were given as 20,000,000 lb., and sales for the month of February at 50,000,000 lb. to 60,000,00 lb., domestic and foreign.

Negotiations between French interests and the committee representing the Export Association are reported to have reached a state where the only bar to the closing of the contract is a question of price. It is expected that the association price of 23 cents for export copper will be lowered, possibly to 17 cents. This French delivery would be for the third quarter of the year.

The other metals are finding a very quiet market and prices are steady.

The old-metal market is demoralized and prices have shrunk. The stock of scrap copper in this country has been estimated at 10,000 tons. If this scrap yields 70 per cent copper, it means about 7000 tons of secondary copper. Stocks in Great Britain have been estimated at twice this figure, and France has considerable.

NEW YORK METAL MARKET PRICES

	Feb. 25	March 4
Copper:	£ s d	£ s d
London, standard spot	75 0 0	74 0 0
	Cents per Pound	Cents pr Pound
Prime Lake	16.50	16.00
Electrolytic	15.37½	14.87½
Casting	15.25	14.75
Wire base	18.75 to 19.00	18.75 to 19.00
Lead, trust price	5.25	5.25
Antimony	7.12½	7.00 to 7.12½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	11.00	11.00
Spelter, spot	6.65	6.62½
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	31.50	31.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13.50 to 14.00	12.75 to 13.25
Brass, heavy	7.50 to 7.75	7.25 to 7.50
Brass, light	6.00 to 6.50	6.00 to 6.25
Lead, heavy	4.25 to 4.50	4.75 to 4.87½
Zinc, old scrap	4.75 to 5.00	4.50 to 4.75

THE WEEK
IN TRADE

EVIDENCES of increased activity in building are seen on almost every hand. With an early spring predicted, business in this line should develop soon. Lighting utilities are planning to make numerous developments shortly.

Prices are slowly weakening. Present firmness, however, is not necessarily an indication of the future. At present a slash in the price of fine sheet goods would probably not cause any great volume of buying, except perhaps for speculation. When, however, it is time for buying to commence there will be a better reason for manufacturers to consider offering better prices. This time, however, is still three or four weeks off.

Collections appear to be coming in satisfactorily. Because of income-tax payments this month might show somewhat slower payments.

The material-disposal section of the Bureau of Aircraft Production, under the direction of Lieut. Charles S. Shotwell, will issue bulletins on materials as soon as they are established as a surplus. Electrical machinery is classified as 6-2. Sales negotiations will be handled by salesmen in each of eight district branches, to be established in Boston, Buffalo, Chicago, Dayton, Detroit, New York, Pittsburgh and San Francisco.

Labor conditions continue to show increasing non-employment. There are numerous local disturbances, and wage rates are tending higher. All this was to be expected, but the situation is much easier than was anticipated. An early spring would, of course, help the situation consideraly, not only by furnishing more outlets for labor, but also by quickening the seasons of vegetable and other farm supplies.

NEW YORK

Despite the unrest manifest in the labor situation, building activities show a decided increase over the first two months of last year. In the third week of February more than $3,000,000 worth of contracts for buildings in the metropolitan district were let, nearly three-quarters of which were for private purposes, the remainder being state, municipal and government. With the United States Department of Labor backing it, the nation-wide "build-your-own-home" campaign is gaining headway, according to reports.

The amount of new line extensions continues small, and the new buildings for which contracts have been let are not yet ready for the electrical trade. Still, several steam plants have been reported changed over to electric drive for industrial and refrigerating purposes.

Rubber-covered wire is continuing down with the decline in price of copper. Knob, cleat and tube porcelain is off, and wood cross-arms have dropped slightly.

LAMPS.—The new small-sized bulb for the 23-watt and 25-watt low-voltage lamps, according to a statement by the Westinghouse Lamp Company, will not be available until some time in April or possibly later. It was anticipated that the bulbs would be available about Jan. 1, but owing to war conditions there were unforeseen delays in getting the molds.

VACUUM CLEANERS.—The inability of some manufacturers to keep up with their orders shows the trend of the market.

PORCELAIN.—Knob, cleat and tube porcelain has been reported as off 40 per cent in price.

CONTROL EQUIPMENT.—A very satisfactory market is reported in both automatic and manually operated equipment, with deliveries much improved.

WOOD CROSS-ARMS.—A drop of 5 per cent is reported on carload lots at the mill, with deliveries around two weeks.

WOOD POLES.—Stock deliveries can be made on cedar poles, while two to three weeks is necessary on chestnut. This is much better than former deliveries on chestnut, as hauling and cutting facilities are now available.

ATTACHMENT PLUGS.—Plugs and switches are finding a very active market with manufacturers of socket devices.

METERS.—Little activity is reported in this field, owing to the small number of extensions by lighting and power companies.

KNIFE SWITCHES.—A considerable market is found for switches, both exposed and incased in an iron box for safety and fire-protection purposes. No drop in price is predicted.

RUBBER-COVERED WIRE.—Average base is just under 23 cents. The majority of manufacturers quote on 23 cents, as was the case last week. A couple of manufacturers are a cent or two lower than last week, one quoting as low as 20 cents.

BOSTON

Trade still moves along conservative lines, with cautious buying and few commitments to new electrical projects. Inquiries are demanding much attention, however, and a moderate amount of building construction is reported. The Worcester (Mass.) Electric Light Company has inaugurated a house-wiring campaign, and the falling price of wire bids fair to see a good deal of work hitherto delayed by war conditions resumed. Spring is almost upon the industry, even in New England, and a reasonable amount of central-station activity along new-business lines will soon have its effect on stocks. Prices show tendencies toward weakness in motors of the smaller sizes, and wire is off about 2 cents compared with a week ago. Two makes of motors are quoted about 10 per cent lower this week than recently. Collections show little change from week to week. Stocks are in substantial volume, and the high prices represented in the jobber's investment are being held up pretty firmly. No shortages of moment are reported. Great interest is being shown by the public in automobiles, and at the Hartford show last week three of the latest models of electric passenger coupés were sold off the floor before the week was half gone.

APPLIANCES.—The demand is well maintained, with firm prices. A prominent manufacturer reports that he cannot fill orders now in hand for irons, grills and heating pads. Factory stocks are low. The high price of labor is a decided deterrent of lower prices on these outfits. Raw materials are plentiful. There is a feeling that unless the jobbers in many cases begin to stock up faster on appliances there is a fair chance of their being obliged to face a shortage later in the year. All signs point to a big year in electric labor-saving devices and household conveniences.

ELECTRIC PASSENGER VEHICLES.—Prices of one leading make rose $250 Feb. 15, making the current selling price for a popular model $2,450. Dealers report a very active market and announce that it is becoming more and more difficult to obtain prompt deliveries. The Detroit Electric Car Company is planning to build a service station and agency quarters soon in New Haven, Conn.

WIRE.—Bare copper wire is quoted at 18 cents base this week, weatherproof at 21 cents, and rubber-covered at 22 cents. The demand is still very moderate, but the opinion is being advanced that as soon as buying sets in on a considerable scale prices will spurt upward again.

PORTABLE TESTING COILS.—The demand is increasing somewhat, although the market for testing panels is rather quiet just now. Prices are firm on account of high labor costs.

SWITCHES AND SOCKETS.—Business from the manufacturer's viewpoint begins to show some improvement. Apparently a low point was reached about three weeks ago. Jobbers are less timid in buying, and some ordering is noted for fixture work. Factory stocks are well built up for prompt delivery, and prices are still firm. Raw material is now plentiful. Short-time running is being carried out to some extent. Service men are being taken back as a uniform policy.

GENERATORS.—Interest is well maintained in small alternating-current generators for water-power services. Prices are still steady, and inquiries well maintained.

MOTORS.—Ten per cent price reductions are reported in the cases of two prominent makes of small motors. Motors are not moving very fast, and some dealers hope to stimulate activity by making concessions.

CONDUIT.—Pipe is in good supply and in comparatively small demand. The release of conduit by war plants is affording an opportunity for some buyers to obtain material of the slightly used variety for stock at prices somewhat below the manufacturers' quotations.

RADIATORS.—Stocks are fair as to size. A revival of business is expected during the next few weeks, with later sales for summer home use.

CHICAGO

Business in the Chicago district has been greatly stimulated by the action of Congress in validating informal war contracts, of which there are about 640 in this district. The claim board of the United States Army Ordnance Department is adjusting claims with dispatch, and the claimants are receiving checks in full settlement about ten days after the adjustment figure has been agreed upon. Claims for stocks of material purchased at abnormal prices are usually adjusted by paying the contractor the difference between present prices and what was actually paid for the material. Even on this basis of settlement, Chicago manufacturers will probably receive about $150,000,000 from the government. When the government fulfills its obligations to the manufacturers the latter will be in a position to proceed with their plans for extensions requiring both labor and materials.

Chicago manufacturers are looking for business abroad. The Bates Expanded Steel Truss Company intends to manufacture steel poles in Italy and has shipped all the equipment required for its Italian factory.

Building is still being held back by high prices of building materials, but there will be a flood of orders when prices weaken.

APPLIANCES.—These have developed into a stronger line with the jobbers than ever before. Prices are firm and deliveries are good.

SCHEDULE MATERIAL.—There is little demand owing to the lack of building.

LAMP GUARDS.—Manufacturers report increasing requirements from the trade, especially for those guards which prevent theft of lamps.

WIRE.—The base on rubber-covered wire is from 20 cents to 23 cents. Bare wire is around 18 cents, and weatherproof ranges from 18 cents to 21.75 cents. The demand is light.

FARM-LIGHTING OUTFITS.—There is a steady increase in sales, and one manufacturer is unable to keep up with orders.

ATLANTA

The undertone of trade in general is strong, and while the sagging price of copper has tended to retard heavy buying, the volume of sales this week compares favorably with the last two weeks of February. Manufacturers report continued activity on the part of the smaller central stations in their purchases of supplies and especially for meters and distributing-type transformers. On the whole, the jobbing field maintains a healthy condition. Sales vary in the several Southeastern states, depending on circumstances. One jobber, however, claims that his sales for the first two months of this year are approximately 40 per cent greater than for the corresponding period in 1918. A few jobbers are very active and are leaving no stone

unturned in their efforts to open up new channels of trade.

Reports from Charleston indicate that the Standard Oil Company will spend $10,000,000 for the erection of a refinery, 127 acres having been bought for this purpose.

The labor situation is quiet this week. Although the electrical workers have returned to the shops not in agreement with the employers' association, quite a number are still out. The contractors assert that the labor situation, so far as they are concerned, is rapidly reaching normal.

LAMPS.—Manufacturers and distributers state that trade is very active, and the outlook is so good that selling and distributing facilities are being extended to meet coming conditions. The average wattage per lamp is slowly increasing. Local stocks are accumulating. The demand for miniatures exceeds the supply, and incoming shipments are not yet sufficient to keep down the insistent pressure from dealers.

LEAD-BURNING TRANSFORMERS.—While this device has been on the market for some time, it has not been pushed on account of crowded factory conditions and long shipments. There is a big market for this outfit in the battery-repairing field, and dealers are beginning to go after this business actively. This transformer is not expected to displace the present gas-burning equipments, but merely to supplement these for finishing and trimming purposes. Shipments are promised for one month.

STREET LIGHTING.—The number of inquiries appears to be increasing each week. These are exclusive of maintenance. Manufacturers are looking forward to a good business as the warmer months approach. No change is noted in prices lately.

CHARGING OUTFITS.—These equipments are enjoying an ever-increasing market. Factory shipments, while showing some improvement, are still bad, and the manufacturers are having difficulty in satisfying jobber and dealer pressure for better deliveries. Jobbers expect a big sale in the larger-type rectifier now being brought out. Prices remain firm.

WIRE.—Weatherproof base has dropped to 18 cents. Rubber-covered and lamp cord remain around a 23-cent base. Buying is affected somewhat by the unsettled copper market, but the demand is fairly steady. Orders are increasing, but the volume per order is less than recorded for several weeks past. Stocks and shipments satisfactory.

WIRING DEVICES.—No change in price has been recorded for this week. Local stocks are in pretty good shape. The demand is well maintained, but buyers are not stocking up.

LAMP CORD.—Movement is rather slow at this time. Stocks are ample to take care of current requirements.

SEATTLE—PORTLAND

It is believed that only a few days will elapse before the workers in the Northwest will begin voting to call off the strike which has paralyzed shipbuilding since Jan. 21. A conditional agreement to submit the question of calling off the strike to a referendum vote of labor was reached at a joint meeting of the Seattle and Tacoma Metal Trades Councils recently. The Gray's Harbor Metal Trades Council has issued orders to unions of which it is composed to begin at once a referendum vote on the return to work of telephone operators, linemen and other electrical workers in Washington, Oregon, California and Nevada. Representatives of employees who would be most directly affected by labor unrest and any tendency toward Bolshevism are showing much confidence in the present outlook.

The Portland district reports wholesale jobbing business as good during the past week with collections at normal. Retail trade is active, considering the season. The Spokane district reports wholesale trade as continuing fair and retail business as good with collections satisfactory. Both wholesale and retail business in Tacoma is very quiet, principally owing to the strike. Approximately forty wooden vessels in the Portland district will be affected by the latest order of the Emergency Fleet Corporation that machinery installation be halted. An almost wholesale rejection of recent bids for the $10,000,000 of equipment of the United States Spruce Corporation opened in Portland is announced. The sales board has adopted a policy whereby prices commensurate with the ruling market will be fixed on most of the major equipment. All bids save those that were clearly coincident with the contemporary market were rejected. The lumber market continues strong, and Northwest lumbermen report new business developing in considerable volume in the past week. Orders received by 119 representative mills in Oregon and Washington were nearly 15 per cent above shipment and 13 per cent above production.

FIXTURES.—A decrease in demand for medium-priced fixtures is noticed, particularly by the Seattle trade. Inclement weather and the labor situation are retarding building. Stocks of both jobbers and dealers are in excellent shape. It is believed that the fixture business will be heavy during coming spring and summer.

SAN FRANCISCO

Weather conditions continue to be ideal. Business is very fair and along the same lines. House-wiring devices are still a little slow, but there are signs of an almost feverish activity in the booming of electrical household devices.

An unusual amount of large building has been reported during the past week, a great deal of it coming from the Central Valley. For instance, Sacramento reports a new million-dollar department store and a project to cost $2,500,000 in West Sacramento for a gigantic stockyard and packing house, to be supplemented later by a fruit and vegetable cannery. The Great Western Power Company, with power houses about 50 miles north of Sacramento, reports two new projects, one of $7,500,000 at Caribou Lake, to be begun immediately, and another project even larger, aggregating $10,000,000, to be constructed in the near future near the head of the Feather River. As signs of the new prohibition law, there have been several permits taken for the conversion of California wineries to canneries, and several Los Angeles contractors report jobs for breweries over the border. Recent meetings of California commercial bodies have predicted that this year will begin a new movement whereby the state will become more and more a manufacturing and industrial center.

TAPE.—This staple has fluctuated several times during the year, the latest having been a 5 per cent increase after a 10 per cent decrease. In looking over prevailing prices it is noticed that rubber and friction tape seem to have reversed their 1917 prices. Several large orders for friction tape are reported from the street railways, and a big shipment of rubber tape has been received by one of the Bay City shipyards.

RANGES.—During the past two weeks electric ranges seem to have usurped the previous position of washing machines as the device showing the greatest activity. A big range demonstration is being planned for Richmond, and dealers over the state are finally undertaking the sale of electric ranges and are beseeching the power companies for rates, power and permission to make extensions. The range rate in San Francisco has been increased to 3 cents per kilowatt-hour with a monthly minimum of $1.

FARM PLANTS.—There has been a greatly increased activity in 32-volt plants, and many sales are reported by agents, especially in the southern part of the great central valley. It is significant that regularly appointed agents make the greater part of these sales.

MEDICAL DEVICES.—Heating pads have been in the greatest demand during the past season, and there is practically no local stock, new shipments being ordered before their arrival. Vibrators have also been very difficult to secure and have been sold out continuously for the past three months.

LAMPS.—The price of carbon lamps has decreased about 15 per cent over prices prevailing during last season. The demand has considerably decreased. Deliveries on tungsten lamps are very good in practically all sizes, voltages and styles.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single trip	$75.00	$63.75— 69.75
3/8-in. double strip	75.00— 82.50	72.00— 75.00
1/2-in. single strip	100.00	85.00 — 93.00
1/2-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.25 to $63.75
3/8-in. double strip	78.25 to $78.75	71.25
1/2-in. single strip	100.00	75.00 to 85.00
1/2-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05½	1	$0.25
1/2	.06	1 1/4	.33
3/4	.09	1 1/2	.40
3/4	.12	1 1/2	.47
3/4	.15	2	.55
3/4	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$25.00–50.70	$24.00–35.20	$23.00–30.25
1/2-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$60.00	$30.00	$26.00–26.50
1/2-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08½
3/8	.08½
1/2	.08½
3/4	.11½
1	.17
1 1/4	.23
1 1/2	.27½
2	.37½
2 1/2	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb	7% to 7.1%	9% to 9.1%
2500 to 5000 lb	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+3%	+1% to 2%
2500 to 5000 lb.	+1% to 2%	+4%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.50 to $7.00
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.18—$40.77
Coil to 1000 ft	28.60— 32.98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.00—$36.00
Coil to 1000 ft	25.00— 27.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 329	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$20.00 to $21.00
1/5 to std. pkg	17.00 to 17.85
Standard package, 2200. List per 1000, $21 to $34	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21.00–$24.15
1/5 to std. pkg	17.85– 21.00
Standard package, 2200. List per 1000,	$20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16.00	$26.00
1/5 to std. pkg	13.60	21.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%–+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5% to 5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to list
1/5 to std. pkg	+5% to 10%
Std. pkg	8% to 18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2.00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.41–$0.66
No. 18, full spools	.39– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.60 to $0.90
No. 18, full spools	.53 to .64

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.50–$25.00	$10.50–$17.00	$10.50–$15.00
12	20.20– 27.09	18.18– 23.22	15.15– 23.22
10	27.00– 32.40	24.30– 32.40	19.44– 27.45
8	33.12– 45.72	30.36– 45.72	26.50– 38.10
6	52.50– 72.36	48.13– 60.30	42.00– 57.88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19.50–$20.00	$14.50–$15.00	$13.00–$14.50
12	17.50– 24.57	17.55– 24.57	17.55– 21.06
10	24.05– 32.97	24.05– 32.97	21.16– 28.26
8	33.35– 46.69	33.35– 46.69	29.35– 40.02
6	52.95– 73.71	46.60– 63.18	46.60– 52.65

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$26.75 to $34.75
25 to 50 lb	26.75 to 34.75
50 to 100 lb	25.75 to 33.75

CHICAGO

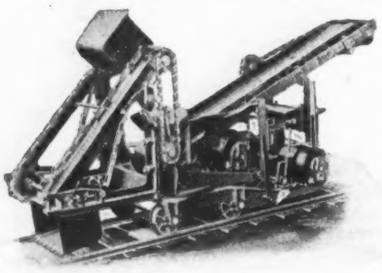
	Per 100 Lb. Net
Less than 25 lb	$32.75 to $35.75
25 to 50 lb	31.75 to 34.75
50 to 100 lb	30.75 to 37.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Continuous Twin-Scoop Loading Machine

A mine loading machine known as the McDermott continuous twin-scoop loader has been placed on the market by the Wellman-Seaver-Morgan Company of Cleveland, Ohio. As its name implies, this machine digs loose ore, dirt or muck by a continuous scooping process, the material being taken up by scoops or buckets on an endless chain, elevated and dropped in a hopper which feeds to a conveyor belt that in turn loads into a car. The scooping mechanism is so pivoted that it can dig to the side as well as in front of the machine. However, the ore, being delivered to the conveyor through the hopper, reaches the car behind the loader no matter at what angle the scoop is working. The movement of the scoop is continuous, not reciprocating. The machine is self-propelled and is so dimensioned that it can easily be transferred around the mine. It is said to load at the rate of more than a ton a minute and may be operated by unskilled labor. While especially designed for underground work, the loader, according to its maker, is not limited to this application, but can also be used on the surface for loading coal from piles to cars, removing piles of rock and sand and similar operations.

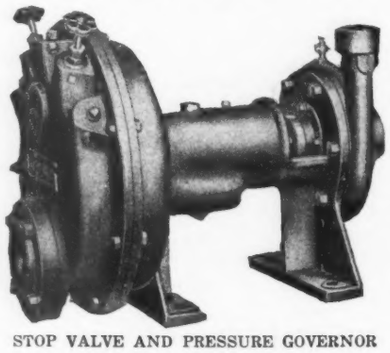


MOVEMENT OF SCOOP IS CONTINUOUS INSTEAD OF RECIPROCATING

Three main parts—truck, digging head and conveyor—constitute the loader. These parts can readily be dismounted and reassembled, permitting ease of handling in getting the machine under ground and in shifting from level to level. Levers for operating the loader are placed at one side in a position convenient for the operator to see the several movements. His duties consist of keeping the machine well up to the pile and swinging the shovel from side to side of the drift. Motors wound for 230 volts, direct current, are provided and furnish power for all the operations. These motors are entirely inclosed, and all chains and gears have suitable protective guards. The whole framework is of steel, the digging head is mounted on a large ball bearing, and all parts are protected as much as possible against dirt and water. Chains are arranged so that they can be easily tightened, and the digging edge of the bucket is filled with renewable tooth sections.

Centrifugal Turbo Boiler-Feed Pump

In designing its type CCC centrifugal turbo boiler-feed pump it has been the aim of the Coppus Engineering & Equipment Company, Worcester, Mass., to develop a pump having few working and wearing parts, requiring little floor space and attention and delivering a continuous steady flow of hot water into the boiler without pulsation. One shaft serves for both pump and steam turbine, and the turbine casing, bearing housing and supporting feet for the machine are cast in one piece, making a complete unit. One oil reservoir serves both bearings, and the oil level for the bearings is said to be maintained regardless of the quantity of oil in the chamber.



STOP VALVE AND PRESSURE GOVERNOR REGULATE WATER SUPPLY

The feed-water capacity is regulated by means of an automatic safety stop and excess-pressure governor. It is pointed out by the maker that these pumps can run for some time against a closed discharge line without injury to either pump or lines. Therefore, in case of necessity, the water may be cut off by the hand valve at the boiler without first stopping the pump. Four sizes of pumps are obtainable, ranging in capacity from 100 b.-hp. to 3500 b.-hp. and having maximum pressures of 135 lb. to 175 lb. (9 kg. to 12 kg. per sq.con.).

High-Voltage Generators for Radio Communication

For use at ground stations in continuous-wave radio work the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has brought out a dynamotor to operate from batteries. It has an input of 10 volts, 9.3 amp., and an output of 80 milli-amp. at 350 volts or 166 milli-amp. at 300 volts. The dynamotor is contained in a metal carrying case, which has a top plate carrying switch, fuses and terminals, to which leads are permanently attached. When not in use, these are folded inside the lid, while a rubber gasket makes the box water-tight when closed. This dynamotor may be used with continuous-wave sets for both telegraph and telephone communication. A similar dynamotor is being made for use on small vessels, the voltages being 27.5 and 300. These machines are mounted in pairs, one serving as a spare, in a spring cradle to minimize noise.

Compact Lecture-Room Oscillograph

By means of the lecture-room oscillograph, which throws large-size images on a screen, it is possible for a number of people simultaneously to view and study such phenomena as armature reaction, alternator wave shapes, current variations in telephone circuits, transients due to switching or sudden applications of load, etc. Harold G. Crane of Brookline, Mass., has recently improved his lecture-room oscillograph, the apparatus now being mounted on one tripod stand instead of three separate ones. The equipment consists of an arc lamp, a magnet and vibrators, and a rotating mirror driven by a small synchronous motor. These units are

ONE TRIPOD MOUNTING MAKES DEVICE MORE PORTABLE

mounted in proper relationship on a movable arm, which is secured by a clamp to the tripod. At the base of the tripod upright is the arc-lamp ballast, and all connections from the various units are brought to terminals on the tripod legs. A shunt and multiplier, not shown in the illustration, are also included in the equipment. The apparatus is ready for use by properly connecting it to the circuit under investigation. It may be used in the laboratory for tracing by means of a small translucent screen placed at one end of the arms.

Motor-Driven Commutator Grinders

Two sizes of the Decker Universal commutator grinder are being marketed by the Shafer-Decker Company of Rochester, N. Y. One, intended for ordinary work, can be used with commutators having diameters up to 30 in. (0.76 m.), and the other, especially for naval use, can be applied to commutators up to 16 in. (0.41 cm.) long. These grinders consist essentially of the base, containing a hollow shaft, and the movable parts which comprise the motor, its carriage, the shafts and the grinding wheels they drive. The motor is of 1 hp. and is belt-connected to the grinding-wheel shaft.

To operate the grinder, its base section is firmly bolted so as to bring the grinding wheel into contact with the commutator. The carriage section may then be shifted from side to side on the hollow shaft in order to bring the grinding wheel into proper position to grind the high and irregular spots. The coarse abrasive wheel is used for the first operation, the armature being rotated at full speed and the grinding wheel being driven at its full speed.

EXTENSION ARM ALLOWS FINISHING IN OTHERWISE INACCESSIBLE PLACES

When a true circumference has been obtained, the coarse grinding wheel is removed and the finer wheel substituted to finish the surface. The regular model of this grinder weighs 600 lb. (272 kg.) and the naval model 325 lb. (147 kg.), so that they are both portable.

Electrical Equipment for Draglines and Shovels

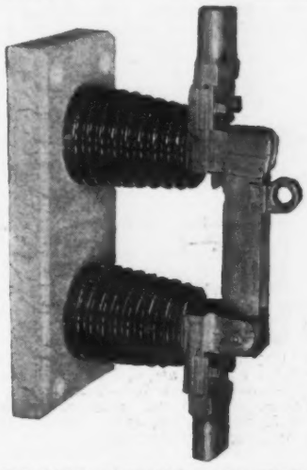
Electrically driven shovels or draglines are used for stripping overburden, mining coal, excavating, dredging, reloading coal and coke, making railroad cuts and similar work. Among the advantages arising from their use are lower operating cost, when fuels are scarce, expensive and hard to transport. Fewer operators are required; fuel is not an essential; there is no water to supply or freeze, no boiler or boiler troubles, no stand-by losses, no smoke, no sparks, no objectionable noises, and more material can be handled. A complete line of shovel and dragline electrical equipment designed to meet the especially severe service encountered in such work has been designed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and consists of wound-rotor motors, magnetic contactors, master controller and transformer apparatus.

Both alternating-current and direct-current equipments can be furnished. In general, the maker points out, the location of the shovels makes alternating-current equipment preferable because this current can be transformed more economically, and by using the alternating-current motors the necessity of converting alternating current to direct current is eliminated, resulting in simpler equipment.

The motors in this new line of apparatus are of the wound-rotor type capable of exerting powerful effort at the instant needed in the cycle of operation. Each motor is mounted on a massive frame with a strong shaft and amply large well-supported bearings of the oil-ring type. The rotating part is of small diameter and consequently has a low flywheel effect, which permits rapid starts, stops and reversals. The motors have few wearing parts and require little attention except for an occasional oiling. The controllers are said to be simple and compact and are designed and arranged so that the operator, by manipulating his master switches, can cause the shovel to respond to his wishes with facility. By means of the protective features of the controllers the shovel or dragline can be operated at its maximum rate of operation without injury to attendants or equipment and without loss of time. Because of this ease and simplicity of control and the savings in power cost the use of this electrical equipment is said to make possible the handling of more material and at a lower cost than where steam drive is used.

Locking Disconnecting Switch

For service on circuits ranging from 2300 volts to 33,000 volts, with ratings of 300 amp. to 2000 amp., a locking-type disconnecting switch is being manufactured by Thoner & Martens, Boston. The locking device, which is unsually simple and compact, consists essentially of a pair of eccentric rings attached to the blade and so arranged that when the switch hook is applied to the rings the pull moves one of them sufficiently against a small spring retention to release a composition arm from a catch mounted at the switch base. The blade, according to the maker, can neither fall out of place when locked in position nor be blown open by magnetic action. The blades are of drawn copper and mounted on porcelain insulators. A 300-amp., 5000-volt switch of this type recently withstood a tensile strain up to 2200 lb. between pillars and the following potential tests: Flashover, 50,000 volts; one minute, 45,000 volts; thirty minutes, 30,000 volts. The manufacturers



SINGLE-POLE, DOUBLE-BLADED TYPE FOR 1500 AMP., 15,000 VOLTS

produce these switches in both single-throw and double-throw designs, with single and multiple blades. The pillars are mounted on cast-iron ferrules or marble as required, wrought-steel bases being used in the former case.

NOTES ON RECENT APPLIANCES

Electric Time Switch

An electric time switch to close and open an electric circuit for evening service is being offered to the trade by L. T. Fenning of Jackson, Ohio.

Grinding and Polishing Machine for Litho Stones

The Cavicchi Polishing Machinery Company of Quincy, Mass., is now selling an electrically driven device for grinding and polishing the litho stones used by lithographers and music printers.

Small-Size Automatic Lighting Plant

A small-size farm-lighting plant which automatically and continuously operates fifteen to twenty lights is now being sold by the Consolidated Utilities Corporation, 730 South Michigan Avenue, Chicago.

Electric Refrigerators

Five styles of motor-operated refrigerators for residence, store, farmhouse and similar requirements are being manufactured by the McClellan Refrigerating Company, 564 West Adams Street, Chicago, with capacities up to 1 ton.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm in Scotland (No. 28,516) desires to purchase three inclosed-type, vertical, three-crank, condensing steam engines, speed not to exceed 350 r.p.m., steam pressure 160 lb., coupled direct to 3000-volt, 500-kw., 50-cycle alternator. Prices should be quoted separately for engine and generator, to be delivered at Cardiff, Wales.

An engineer in France (No. 28,524) wishes to secure an agency for the sale of apparatus for low-tension and high-tension electric current, electric lamps, electric wires and cables, insulation tubes and equipment, electric motors and dynamos, electric meters, etc. He desires to establish a depot of electrical supplies. Correspondence should be in French.

A doctor in France (No. 28,529) wishes to secure an agency for the sale of electrical apparatus used in medicine. Correspondence should be in French.

An engineer in France (No. 28,526) desires to secure an agency for the sale of high-tension and low-tension electrical apparatus, accessories, motors, generators, electric light fixtures, etc. He states that he is willing to come to this country to interview American firms. Correspondence should be in French.

A man in Australia (No. 28,507) desires to secure an agency for the sale of electrical supplies and equipment, electrical apparatus for mines, shipyards, etc., and particularly electrical railway supplies.

A. & T. Burt, Ltd., Dunedin, New Zealand, general importers and exporters, are interested in engineering requisites and lighting fixtures. Correspondence with view of handling American goods is solicited.

The All-Russian Central Union of Cooperative Societies has opened an office at 167 Post Street, San Francisco, Cal., to procure for Russia machinery and supplies which are available quickly and in large quantities. The representative in this country is Alexander Zelanko.

A firm in Italy (No. 28,440) desires to secure an agency for the sale of electrical equipment for power plants and electric light plants. Correspondence may be in English.

A commercial agency in Honduras (No. 28,452) desires to represent firms for the sale of all lines of goods used in tropical countries. Included in the list are electrical novelties. Quotations f.o.b. American port; correspondence in English.

A company in Brazil (No. 28,387) wishes to secure an agency for the sale of electrical materials. Terms, ninety days' sight draft with documents through local banks. Correspondence may be in English.

A man in Australia (No. 28,414) wishes to secure an agency for the sale of electrical goods and fittings.

A man in France (No. 28,416) desires to secure an agency for the sale of electrical machinery. Correspondence should be in French.

A man in France (No. 28,422) wishes to secure an agency for the sale of automobile electric starters. Correspondence may be in English.

A man in England (No. 28,436) desires to secure an agency for the sale of electric motor accessories.

Consul Buhrman reports from Malmo, Sweden, that the consulate is in receipt of inquiries from dealers and importers for catalogs of electrical installation materials. It is suggested that interested manufacturers forward such catalogs to the consulate.

CLOTH FOR STORAGE-BATTERY INSULATION.—*Il Sole*, published at Milan, states that, after a series of experiments made in Venice and Murano by Luigi Bisigato, felt and cloth made from spun glass have now been successfully produced there. A new society, the "Vitrum," has been formed, with extensive plants at Naples, for the manufacture of this felt and cloth for use as insulators in storage batteries.

THE ELLIOTT-LEWIS ELECTRICAL COMPANY, Philadelphia, has recently taken the agency for the Cofferfield electric washer.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the removal on March 1 of its Cleveland district office from room 813 to rooms 406-408 Engineers' Building.

HERBERT L. SHERMAN, formerly president of the New England Bureau of Tests, Inc., and more recently in charge of inspection for the Construction Division of the United States Army, has been placed in charge of the structural material testing department of Arthur D. Little, Inc., Cambridge, Mass., chemists and engineers.

JOHNS - MANVILLE DISTRIBUTES BONUS.—The H. W. Johns-Manville Company will distribute to all salaried employees who were in continuous service for the full calendar year of 1918 an extra compensation of 20 per cent on the salaries paid them during 1918. It has been the custom of the company for some years past to recognize the faithful service of its big business family in this substantial way.

FREYN, BRASSERT & COMPANY, engineers, People's Gas Building, Chicago, announce the appointment of Wyman Eaton as chief engineer, effective Feb. 15. Mr. Eaton was formerly connected with the engineering offices of Julian Kennedy, Youngstown Sheet & Tube Company and others, and recently resigned his position as engineer-in-charge of the rolling mill works of the Mesta Machine Company to take up his new duties.

THE DUNTLEY-DAYTON COMPANY, it is understood, has taken over the entire output of the Dayton Pneumatic Tool Company. The Duntley-Dayton Company, which is located in the Westminster Building, Chicago, is also putting out a complete line of portable electric drills and grinders. W. O. Duntley, former president of the Chicago Pneumatic Tool Company, is president of the new company, and his son, C. A. Duntley, is vice-president.

THE POWDERED COAL ENGINEERING & EQUIPMENT COMPANY, Chicago, announces that Willis B. Clemmitt and George H. Ruppert have become associated with the company as advisory engineers. Mr. Clemmitt was formerly associated with the Central Iron & Steel Company at Harrisburg, Pa., and Mr. Ruppert before his entry into the chemical warfare branch of the service had charge of the sodium-ferro cyanide department of the Semet-Solvay Company.

OMER COX of San Francisco, Cal., has concluded arrangements with the Hygrade Lamp Company, Salem, Mass., to represent it on the Pacific Coast and in the Rocky Mountain region. Mr. Cox has recently visited the home office of the Hygrade company to complete arrangements for distributing its product through the following five offices in the West: Omer Cox, San Francisco, Cal.; Sands & Cox, Los Angeles, Cal.; Strimple & Cox, Seattle, Wash.; Jones & Cox, Salt Lake City, Utah, and Turnbull & Cox, Denver, Col. This organization sold 169 carloads of electrical material on the Pacific Coast in 1918, having been in business but four years, and is looking forward to a much larger volume of trade this year.

GEORGE H. OLNEY has resumed his old position as managing director of the Eugene F. Philips Electrical Works, Ltd., Montreal, Canada.

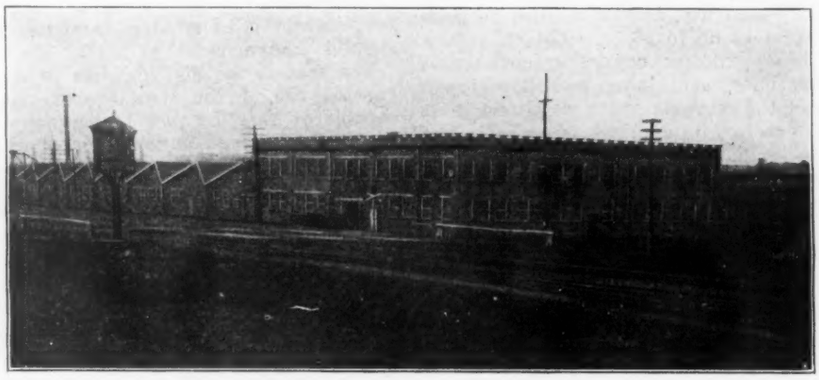
CHARLES PULACHECK & BROTHERS COMPANY, manufacturer of lighting fixtures, Milwaukee, Wis., announces that it is organizing a department of chandelier parts and supplies.

THE APEX APPLIANCE COMPANY, Chicago, manufacturer of washing machines, is planning to build a two-story factory, 60 ft. by 80 ft., at 3241-3247 West Thirtieth Street, Chicago.

R. B. COLEMAN, who was formerly with the Moloney Electric Company, St. Louis, Mo., as manager of its Chicago office, has become a member of the sales force of the Kuhlman Electric Company, Bay City, Mich.

R. I. SMART, formerly professor of railway engineering and transportation at McGill University, and J. A. Burnett, formerly electrical engineer with the Grand Trunk Railway system, are now associated as consulting engineers at 821 New Birks Building, Montreal, and will engage in civil, electrical and mechanical engineering.

THE ELECTRIC FURNACE COMPANY, Alliance, Ohio, has moved into its new factory at Salem, Ohio. An executive office will still be maintained at Alliance. The new plant is a two-story factory with about 70,000 sq.ft. of floor space situated on a nine-acre tract along the main line of the Pennsylvania Railroad at Salem. Adjoining the main two-story building, which is 96 ft. by 100 ft., are two sawtooth-roofed buildings, one 201 ft. by 97 ft. and the other 97 ft. by 54 ft. Provision is made for general offices, a drafting room, a special electric furnace laboratory and space for switch and transformer construction.



NEW PLANT OF ELECTRIC FURNACE COMPANY AT SALEM, OHIO

THE EDW. R. LADEW COMPANY, manufacturer of leather belting, with factory and general offices at Glen Cove, N. Y., announces important changes in its Southern organization, made with a view to more active efforts in the South. O. S. Horton has been appointed manager of the Southern branch, with headquarters at Charlotte, N. C., and territory covering all states south of Maryland, West Virginia, Kentucky and Arkansas, west to Texas. Walter Carr, formerly of the New York office, is assistant branch manager. Several new salesmen have been added to the organization, and a large stock will be carried at the Charlotte office and disposed of through distributers throughout the territory.

CHESTER A. GAUSS, who was formerly in charge of the advertising department of the Crocker-Wheeler Company, Ampere, N. J., has been transferred to the sales department, being temporarily stationed at Ampere. The company's advertising in the future will be handled by Sherman & Bryan, advertising agents, New York, N. Y. Mr. Gauss is a 1912 electrical engineering graduate of Lehigh University. Following his college work, he joined the services of the General Electric Company as a technical writer in its publication bureau. In 1914 he joined the editorial staff of the *Electrical Review* and later the editorial staff of the ELECTRICAL WORLD, from which position he resigned to become associated with the Crocker-Wheeler Company.

THE BELDEN MANUFACTURING COMPANY, Chicago, Ill., manufacturer of wire and cable, it is reported, has increased its capital from $1,000,000 to $1,500,000.

THE CANADIAN ELECTRIC & MANUFACTURING COMPANY of London, Ontario, it is reported, has been purchased by the Western Ontario Electric Company.

THE CHICAGO FUSE MANUFACTURING COMPANY, Chicago, it is understood, is making preparations for the construction of a seven-story plant at Congress and Morgan Streets. It is reported that building will be begun in a few months.

THE CALDWELL ELECTRIC COMPANY, manufacturer of general electrical supplies, Champaign, Ill., is planning to move into the factory building which it recently purchased. The company, it is understood, is also planning the erection of a large warehouse.

FRED R. FARMER, president of the Beardslee Chandelier Company, Chicago, has been elected president of the recently organized National Council of Lighting Fixture Manufacturers. Except for about a year which he spent as sales manager for the Gibson Company, Indianapolis, Ind.,

F. R. FARMER

Mr. Farmer has been with the Beardslee Chandelier Manufacturing Company since about 1900. He was sales manager of the Beardslee company for fifteen years. Then for two years he was vice-president. Since the beginning of 1918, Mr. Farmer has been president of the company.

JOHN G. WADDELL, formerly of the Robertson-Cataract Electric Company, Buffalo, N. Y., and lately with the Wetmore-Savage Company, Boston, Mass., has been placed in charge of the construction department of the Brown-Gates Company, electrical contractor and dealer, Springfield, Mass.

THE MEACHEM GEAR CORPORATION, Syracuse, N. Y., with offices at 411 Canal Street, has been incorporated for the purpose of taking over from the New Process Gear Corporation the manufacture of New Process rawhide pinions and for the general manufacture of gears of all kinds. The company is incorporated for $300,000 and has purchased a three-story building which is to be devoted entirely to the manufacture of gears. The Meachems organizing this company are the same who owned and controlled the New Process Gear Corporation and the New Process Rawhide Company for a period of thirty years, and associated with them are George W. Wood, secretary and superintendent, and H. W. Kiddle, assistant superintendent, who had charge of the manufacture of rawhide and the rawhide pinion department of the old company. The plant purchased is now being remodeled and was to begin operations on March 1, at which time it took over the rawhide pinion business, the hide plant at 811 Free Street, Syracuse, and all of the raw materials and uncompleted orders pertaining to this branch of the business. The company will also manufacture a full line of cut-metal gears for mills and factories of all kinds.

Trade Publications

INTER-PHONES. — Inter-phone outfits are the subject of a new folder of the Western Electric Company, New York City.

SOLDERING IRON.—The Rite Manufacturing Company, Westport, Conn., has got out a folder telling about the "Solderrite" iron.

LIGHTING FIXTURES.—In bulletin No. 7 the World Lighting Appliance Company, New York City, describes some of its lighting fixtures.

PYROMETERS.—The Wilson-Maculen Company of 781 East 142d Street, New York City, in catalog No. 12 describes its line of pyrometers.

CONDUIT FITTING.—"No-splice" blocks are illustrated and described in a new leaflet being distributed by the V. V. Fittings Company, Philadelphia.

FANS.—The dealers' catalog of G. E. electric fans for the 1919 season is being distributed by the General Electric Company of Schenectady, N. Y.

STOKERS.—Two folders which tell about the "Cokal" hand-operated stoker have been prepared by the Cokal Stoker Manufacturing Company, 48 West Division Street, Chicago.

PORTABLE ELECTRIC MACHINERY.—Different portable electric machines are spoken of in a new booklet from the R. G. Haskins Company, 547 West Washington Boulevard, Chicago.

ADVERTISING ELECTROTYPES.—A 1919 catalog of electrotypes of its products for newspaper advertising is being distributed by the General Electric Company of Schenectady, N. Y.

ELECTRIC PORTABLE RADIATORS.—A leaflet setting forth the features of type No. 100 portable electric radiator is being distributed by the Simplex Electric Heating Company, Cambridge, Mass.

INDICES.—An index to its descriptive bulletins and sheets and another to its supply part bulletins, both dated January, 1919, have been issued by the General Electric Company, Schenectady, N. Y.

WIRE TERMINALS.—The Patton MacGuyer Company of Providence, R. I., has prepared a bulletin giving size and weights specifications and line illustrations of its standard copper-wire terminals.

FLASHERS AND COLOR HOODS.—A mailing folder from the Reynolds Electric Company, 422 South Talman Street, Chicago, advocates increased business by using "Reco" flashers and color hoods in advertising signs.

FLEXIBLE COUPLING.—Bulletin No. 26 has been issued by the Smith-Serrell Company, 90 West Street, New York City. It explains the construction, uses and operation of Francke flexible couplings of the heavy-pattern type.

CIRCUIT BREAKERS.—A circular briefly noting the growth of its circuit-breaker business in twenty years is being distributed by the Cutter Company of Philadelphia. Illustrations of two styles of this company's apparatus accompany the circular.

LIGHT AND POWER PLANT.—A reprint of an article in *Automotive Industries*, describing the automatic electric light and power unit made by R. M. Owens & Company, 1 West 142d Street, New York City, is being distributed by this concern.

STEAM TURBINES AND SPEED-REDUCING GEARS.—The De Laval Steam Turbine Company of Trenton, N. J., has just issued a thirty-two-page bulletin, M, which describes geared steam turbines. This apparatus could be used for driving direct-current generators and large centrifugal pumps and fans.

LIGHTING.—"Lighting from Concealed Sources" is the title of a comprehensive 250-page book, with upward of 600 illustrations, which has been written by J. L. Stair and issued by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, of which Mr. Stair is chief engineer. This publication contains a practical treatment of lighting problems involved in obtaining satisfactory illumination and individual effects without exposed light sources. The book is intended primarily for distribution and use among architects, lighting men and contractors, but contains information of value to light users as well. In recording his information the author has preserved a balance between theory and practice, chapters being included on the history of X-ray lighting, the X-ray reflector, the principle of lighting from concealed sources, important laws in the control of light, indirect-lighting theory and practice, planning indirect lighting, application of indirect lighting, lighting from other than ceiling outlets, the Curtis portable lamp, general uses of direct lighting and equipment for it, planning direct lighting, applications of direct lighting, principles of show-window lighting, planning show-window lighting, showcase and wall-case lighting, uses and units for floodlighting, applications of floodlighting, bank desk lighting, definitions of illumination terms, units and quantities, and miscellaneous data valuable to lighting engineers.

New Incorporations

THE WAKEFIELD (NEB.) ELECTRIC COMPANY has been incorporated with a capital stock of $25,000. R. H. Matthewson is one of the incorporators.

THE COOPER (TEX.) POWER, LIGHT & ICE COMPANY has been incorporated by E. D. Borhead, H. B. Borhead and E. Hendricks. The company is capitalized at $50,000.

THE NORMANNA ELECTRICAL COMPANY of Brooklyn, N. Y., has been chartered by S. Kieldsen, B. Hagen and F. Werner, 322 President Street, Brooklyn. The company proposes to do a general contracting business.

THE SOUTHWESTERN UTILITIES COMPANY of Alva, Okla., has been incorporated with a capital stock of $500,000 by Percy Jones of Alva, R. F. Rice of Lawrence, Kan., and Albert Manuel of New York, N. Y.

THE LONGACRE HARDWARE & ELECTRIC COMPANY of New York, N. Y., has been incorporated with a capital stock of $10,000 by B. M. Fando, Harry Thal and Reuben Lebouitz, 438 West Forty-ninth Street, New York City.

THE NORTH AMERICAN ELECTRICAL PRODUCTS CORPORATION of New York, N. Y., has been chartered with a capital stock of $20,000 by M. F. Riley, E. C. Schiffmacher and J. Bernhart, 701 West 179th Street, New York City.

THE AUTOMOTIVE BATTERY & ELECTRIC COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000. The incorporators are: C. L. Rimlinger, M. M. Clancy and P. B. Drew of Wilmington, Del.

THE CALORE CORPORATION of New York, N. Y., has been chartered by J. T. MacGregor, J. Monks and A. H. Schneer, 949 Broadway, New York City. The company is capitalized at $250,000 and proposes to manufacture electric heating and measuring devices.

THE HOME ELECTRIC APPLIANCE COMPANY, of Dover, Del., has been incorporated with a capital stock of $10,000 by W. I. N. Lofland, Frank Jackson and Charles R. Jones, of Dover, Del. The company proposes to manufacture washing machinery of all kinds.

THE KRETSHMER-BERGER COMPANY of New Brunswick, N. J., has been incorporated with a capital stock of $50,000 to manufacture electric and steam equipment, including motors, engines, etc. The incorporators are W. A. and V. P. Kretschmer of Metuchen and R. C. Berger of East Orange, N. J.

THE LIBERTY ALARM & ACCESSORIES COMPANY, Great Neck, N. Y., has been incorporated by F. A. Howe, of Hempstead; W. H. Turner, of Rockville Center, and H. Rohwer, 161 West Ninety-fifth Street, New York City. The company is capitalized at $50,000 and proposes to manufacture electrical products.

THE DONNELL-ZANE COMPANY of New York, N. Y., has been incorporated by J. C. O'Donnell, 148 West Ninety-seventh Street, New York City; H. J. Zane, Jr., Orange, N. J., and C. Ridneur, Millwood, W. Va. The company is capitalized at $25,000 and proposes to do a general electrical and mechanical engineering business.

New England States

BANGOR, ME.—The Bangor Railway & Electric Company is planning to install three waterwheels of 250 hp. capacity each in its Veazie plant during the coming year.

ELLSWORTH, ME.—The Bar Harbor & Union River Power Company, it is reported, is planning to install a 3000-kva. waterwheel-driven generating unit at its local plant during the coming year.

VINAL HAVEN, ME.—The plant of the Islands Electric Company of Vinal Haven was sold at auction recently to H. W. Fifield of Vinal Haven for $25,000. He acted in behalf of the townspeople, who raised the money by public subscription. The plant was built three years ago at a cost of $80,000. Changes will be made in the equipment so that the plant can be operated less expensively.

BRISTOL, VT.—Plans are being prepared by the Hortonia Power Company of Brandon to enlarge its local hydroelectric power plant.

RICHFORD, VT.—The Vermont & Quebec Power Corporation contemplates the installation of a 500-kva. generating unit at its local plant, and also a new water-power development on the Missisquoi River, including dam, power house and transmission line. The plans provide for the development of 1500 hp. The transmission line will be from 15 to 22 miles in length and will carry 13,000 volts.

TEWKSBURY, MASS.—Application will be made to the State Legislature by the board of trustees of the State Infirmary at Tewksbury for authority to expend $28,000 to install a coal-handling plant.

WORCESTER, MASS.—The City Council is considering the installation of a new electric lighting system on Plantation Street.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by Dr. H. M. Biggs, Commissioner of Health, State Department of Health, Albany, N. Y., until March 15, for construction work, sterile rooms, media hood, refrigerator, cupboards, and shelving, electric dumbwaiters and electric clock system, laboratory building, Division of Laboratories, State Health Department, Albany. Drawings and specifications may be consulted at the New York office of the Department of Architecture, 1715 Tribune Building, and at the Department of Architecture, Albany. L. F. Pilcher, Capitol, Albany is state architect.

BAY SHORE, N. Y.—Mortensen & Company, 347 Columbus Avenue, New York City, have been engaged to prepare plans for an ice plant, including main factory buildings, boiler and engine plants and auxiliary buildings, to be erected at Bay Shore, for a new company being organized by Arthur Kelly and Wesler M. Oler, Jr., of the Knickerbocker Ice Company, 1480 Broadway, New York City. The cost of the proposed plant is estimated at about $100,000.

BROOKLYN, N. Y.—Contract has been awarded by Julius Kayser & Company, 45 East Seventeenth Street, New York City, for the construction of a power house, 50 ft. by 85 ft., on Classon Avenue.

BUFFALO, N. Y.—Bids will be received by the Commissioner of Parks and Public Buildings, until March 11 for the installation of lighting fixtures, conduits, electric wiring and other electrical work in connection with alterations and improvements to be made in the Stinson Building, Seventh Street, which it is proposed to use as an annex to Public School No. 1. John F. Malone is commissioner.

IONA ISLAND, N. Y.—Plans have been prepared by the Navy Department, Washington, D. C., for an addition to the power plant at the local station. The cost is estimated at about $30,000.

LOCKPORT, N. Y.—Plans have been completed by the Lockport Hydraulic Race Company for the construction of a new hydraulic power plant with a group of industrial buildings. A large quantity of power machinery, electrical equipment and auxiliary apparatus will be installed. Charles E. Dickinson is president.

NEW YORK, N. Y.—Plans have been prepared for extensive alterations and improvements in the old Stewart Building, Broadway and Chambers Street, in connection with the proposed new printing plant to be installed by Frank Munsey. Considerable electrical equipment, it is understood, will be required.

NEW YORK, N. Y.—Preparations are being made by Lewis Nixon, State Superintendent of Public Works, to rush to completion construction work on the terminals in New York for barge canal purposes, to cost about $400,000. The proposed work will include barge canal terminal and frame freight house, Flushing, estimated cost, $162,590; the erection of two 1½-ton electric overhead wharf cranes at Pier 6, East River, to cost $28,000; erecting electric capstans and trolley hoists at points along the canal not yet designated, $15,000; erecting four semi-portable revolving jib cranes, two each at Greenpoint and West Fifty-third Street, New York City, $92,598; constructing barge canal terminal freight shed at Pier 93, West Fifty-third Street, North River, at $53,969, and installing battery-charging motor-generator sets for terminals in New York City, $7,800. Bids, it is understood, are to be advertised immediately, and the contracts awarded early in the spring.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

OSWEGO, N. Y.—The city has voted $150,000 to be added to the existing appropriation of $345,000 to develop water power. W. A. McCaffrey is superintendent of water works.

PORT HENRY, N. Y.—The Port Henry Light, Heat & Power Company, it is reported, is contemplating the construction of a new hydroelectric power plant near Millbrook, N. Y. I. M. Frost of Rutland, Vt., is vice-president.

SAVONA, N. Y.—A franchise has been granted to Charles D. Davis to construct and operate an electric light plant in Savona. The village will contract for street-lighting service.

JERSEY CITY, N. J.—Plans have been completed by Percie A. Vivarttas, 110 Fourth Street, West New York, for the proposed building, 95 ft. by 107 ft., for power house, heating and lighting plant, to be erected at Laurel Hill to furnish service for the county buildings, etc. Oscar L. Aufuder Heide, Court House, is chairman of Board of Chosen Freeholders.

LAKE DENMARK, N. J.—Plans have been completed by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a new lighting system at the local naval station, to cost about $50,000.

NEWARK, N. J.—Plans have been prepared by the Hay Foundry & Iron Works, 93 Plum Point Lane, for alterations and improvements in its power plant.

NEWARK, N. J.—The American Oil & Supply Company, 52 Lafayette Street, Newark, it is reported, is planning to erect a new plant on Wilson Avenue, to cost about $100,000. New equipment, including electric motors, pumping equipment, boiler apparatus, etc., it is understood, will be required.

ALLENTOWN, PA.—The City Commission has engaged Frank Koester, 50 Church Street, New York, N. Y., consulting engineer, to make investigations as to the feasibility of installing an electric lighting plant at the city pumping station to utilize the excess boiler capacity.

GOODVILLE, PA.—The Tri-County Electric Company, it is reported, contemplates changing its entire system to three-phase, whinh will require a separate wire of about 6 miles. The rest of the system is already operated at three phase.

HARRISBURG, PA.—An ordnance is under consideration by the City Council providing for the installation of underground electric conduits to replace all overhead telephone wires and the removal of all existing poles.

WILKES-BARRE, PA.—Bids will be received at the office of the city clerk, City Hall, Wilkes-Barre, until March 11 for furnishing materials and labor for changing over the present four-lamp and five-lamp clusters on East Market Street, North Main Street and Public Square in the city of Wilkes-Barre, in accordance with specifications on file in the office of the city clerk. Fred H. Gates is city clerk.

WINDBER, PA.—The Berwin-White Coal Mining Company of Windber, it is reported, contemplates the construction of an electric power plant to supply electricity to the eight mines of the company. The company, it is stated, will also open two new mines in the Windber district within the next year.

YORK HAVEN, PA.—The York Haven Water & Power Company is contemplating extensions and improvements to its hydroelectric power plant. Gannett, Seelye & Fleming, engineers, 204 Locust Street, Harrisburg, have been engaged to make investigations and report on same.

BALTIMORE, MD.—Bids will be received at the office of the city registrar, City Hall, Baltimore, until March 15 for furnishing and erecting one 30,000,000 gal. turbine-driven centrifugal pump, reduction gearing, condenser and auxiliaries, including condensate and air removal pumps. Plans and specifications can be obtained at the office of the water engineer, City Hall, Baltimore, upon deposit of $5. Walter E. Lee is water engineer.

CHARLESTON, W. VA.—The Fryland Coal Company, recently organized, is contemplating an expenditure of $50,000 for erecting a plant in Kanawha County. Two drift mines will be opened, equipped with electrically driven machinery. C. G. Rowland of Nitro is president.

MARTINSBURG, W. VA.—The new plant of the Berkeley Woolen Mills, now under construction at Raleigh and Stephens Streets, Martinsburg, it is understood, will be equipped with electrically operated machinery. The cost of the plant is estimated at $100,000.

NORFOLK, VA.—Arrangements are being made by the Seaboard Ice & Cold Storage Company of Norfolk for the construction of a new ice manufacturing and cold storage plant, to cost about $500,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until April 4, Portsmouth, Schedule 3848—30,000 lamp sockets. Washington Navy Yard, Schedule 3849—miscellaneous electrical equipment; Schedule 3852—3000 ft. electric cable. Until March 14, f.o.b. works, Schedule 7836½—generators, extensions, shaft and ammeters with scale. Alexandria, Va., Schedule 7839½—miscellaneous conduit and conduit fittings. Applications for proposal blanks should designate the schedule desired by number.

North Central States

BOYNE CITY, MICH.—Plans are under consideration by the City Council for the installation of an ornamental lighting system on five blocks.

DETROIT, MICH.—The Public Lighting Commission is planning to expend about $500,000 during the ensuing year for the construction of conduits, street-lighting equipment, pole lines and underground cable.

HUDSON, MICH.—Arrangements are being made by the Southern Michigan Light & Power Company to extend its transmission lines to supply electrical service to surrounding villages and to farmers along the line. C. J. Avis is manager.

KALAMAZOO, MICH.—The City Commission is considering the installation of a municipally owned electric plant to supply electricity, lamps and motors for commercial purposes. The present plant furnishes street-lighting service only. The commission is also considering the installation of 22 new fire alarm boxes in the business section, rewiring practically all the alarm circuits, and replacing 12 boxes now in use in the residence portion of the town.

RIVER ROUGE, MICH.—The Ford Motor Company, it is reported, will soon receive bids for the construction of a substation and transformer house, 40 ft. by 80 ft., and a pig-casting machine shop, 70 ft. by 300 ft., in River Rouge.

ALLIANCE, OHIO—An election will be held on March 18 to submit the proposal to issue $200,000 in bonds for construction of an electric light and power plant.

DAYTON, OHIO—The Dayton Power & Light Company has completed the erection of its transmission line from its new plant at Miller's Ford to Piqua, a distance of 40 miles. The company hopes to complete this year its transmission line from Dayton to Wilmington, a large portion of which is now in operation. About 12 miles of construction will be required to complete the connection to Wilmington. This line will be approximately 42 miles in length.

OXFORD, OHIO.—Robert S. Ashe, president of the Liberty Light & Power Company of Richmond, Ind., has submitted a bid to the Village Council to supply electricity in Oxford.

LEXINGTON, KY.—The rebuilding of part and possibly the entire municipal electric lighting system, consisting of approximately 700 lamps, changing from the present series multiple system to Mazda lamps, is under consideration by the Lexington

Utilities Company. The company also contemplates numerous extensions to its commercial lighting and power circuits as required from time to time.

LINN GROVE, IND.—The Linn Grove Light & Power Company has purchased at receiver's sale the overhead wire system of the defunct Bluffton, Geneva & Celina Traction Company between Bluffton and Geneva and also the entire distributing system at Linn Grove and Geneva. The Linn Grove company at present is securing energy from the Marion & Bluffton Traction Company, but has contracted to purchase electricity from the municipal electric plant in Bluffton. The change will be made as soon as the necessary equipment can be installed. Arrangements have been made to supply electricity in Vera Cruz and Craigville from the Linn Grove lines, and a line may also be extended to Berne.

MORAN, IND.—The Moran Electric Light & Power Company, recently incorporated with a capital stock of $15,000, is planning to furnish electricity in Moran. The company will secure electricity to operate the proposed system from the Terre Haute, Indiana & Eastern Traction Company. N. E. White is interested in the company.

ROCKFORD, ILL.—Extensions and improvements are contemplated by the Rockford Electric Company, including the installation of a 7500-kw. Curtis turbine, changes in coal-handling apparatus, switching apparatus and extensions to its distribution lines.

SPRINGFIELD, ILL.—The City Council is considering extensions to the municipal electric light plant and the installation of a municipal heating plant.

VARNA, ILL.—The local substation of the Central Illinois Public Service Company of Mattoon was recently destroyed by fire.

BURLINGTON, WIS. — The Burlington Brass Works is contemplating the construction of four new foundry and machine units, to cost $250,000 complete. The first unit, it is understood, will be built this coming summer. H. L. Sierks, 108 North Dearborn Street, Chicago, Ill., is architect.

MADISON, WIS.—F. L. Kronenberg, architect, Carroll Building, has been engaged by the Board of Education to prepare plans for a new high school building, to cost about $250,000. The plans will provide for a manual training and domestic science department, assembly room, gymnasium, etc.

RADISSON, WIS.—Plans have been prepared by L. A. De Guer, engineer, Wood County Bank Building, Grand Rapids, for the construction of a reservoir at Radisson, for the Wisconsin-Minnesota Light & Power Company, to cost about $500,000.

HIBBING, MINN.—Bids, it is reported, will be received by C. Foster, engineer, of the Hibbing Power & Light Company, until March 10, for the construction of power house, 104 ft. by 158 ft., three stories, on Main Street, to cost about $150,000.

DUBUQUE, IOWA—The City Council is considering establishing a municipal electric light plant in Dubuque. The cost is estimated at $250,000.

MACON, MO.—Bids will be received by W. H. Martin, city clerk, Macon, until March 20 for furnishing and installing one 400-kva. to 450-kva. electric generating unit directly connected to a uniform or compound Corliss engine, condensing equipment, spray-pond equipment and switchboard for same. Specifications may be obtained from Frank L. Wilcox, engineer, Syndicate Trust Building, St. Louis, Mo.

MEMPHIS, MO.—The Memphis Electric Light, Heat & Power Company is reported to have decided to install an ice plant in connection with the electric plant.

ST. JOSEPH, MO.—The City Council has adopted a resolution to call a special election to vote on the proposal to issue bonds to enlarge the municipal electric light plant and to erect a municipal ice and fuel plant, provided that the citizens desire such an election. With the expiration of the contract with the St. Joseph Railway, Light, Heat & Power Company to furnish electricity for the ornamental lamps in the downtown section, the streets have been dark, with the exception of electric signs and show windows. The standards and fixtures are owned by the electric company.

FARGO, N. D.—The city is contemplating the construction of three garages, to cost from $50,000 to $100,000 each.

FESSENDEN, N. D.—Arrangements are being made by the Fessenden Light & Power Company for the erection of a high-tension transmission line 19 miles in length to an adjoining town; also an extension of one of its high-tension lines into a new territory, a distance of 8 miles. The company is negotiating with a third town to furnish electrical service, which if carried through will necessitate the installation of an additional 200-hp. unit.

STANLEY, N. D.—The Public Utility Company contemplates improvements to its plant and system, including the installation of generators, engines, switchboards, etc. The company expects to purchase the above equipment, also line material and alternating-current meters, in about three months. R. F. Wheelock is manager.

WATERTOWN, S. D.—Bonds to the amount of $175,999 have been authorized for the installation of a municipal electric light plant.

ARAPAHO, NEB.—Plans are being prepared by Grant & Fulton, engineers, Lincoln, for a hydroelectric plant to be built by the city of Arapaho and the Arapaho Milling Company.

ASHLAND, NEB.—Improvements are contemplated by the Ashland Light, Mill & Power Company for improvements to its plant, including the construction of a new wheel pit, installation of a new waterwheel with generator, directly connected, and waterwheel governor, and also other minor improvements.

OMAHA, NEB.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 15, for the installation of three electric triplex elevator pumps, etc., in the United States post office at Omaha. Specifications may be obtained at the above office.

PLYMOUTH, NEB.—The city is considering the installation of a municipal electric lighting system. Energy will probably be secured from Fairbury or Beatrice.

STERLING, NEB.—Bids, it is understood, will soon be asked for the installation of a municipal electric lighting system. Grant & Fulton, of Lincoln, are engineers.

WICHITA, KAN.—The installation of an ornamental lighting system on First Street, from Main to Lawrence Street, is under consideration.

Southern States

CHARLESTON, S. C.—Contract has been awarded by the General Asbestos & Rubber Company to the Fiske-Carter Construction Company of Greenville, S. C., for the construction of an electric generating station. The proposed plant will have an output of 750 kva. and will cost about $60,000. Lockwood, Greene & Company, Atlanta, Ga., and Boston, Mass., are engineers.

CORDELE, GA.—The City Council has engaged Lockwood, Greene & Company, engineers, of Boston, Mass., to investigate the local properties of the Georgia Public Service Company with a view of taking over same to be owned and operated by the municipality.

TALBOTTON, GA.—The Talbotton Electric Light Company, recently organized, is planning to install an electric light plant, the cost not to exceed $7,000. J. W. Jordon and others are interested in the company.

LEESBURG, FLA.—At an election to be held March 12, the proposal to issue $30,000 in bonds to purchase or build an electric light plant will be submitted to the voters.

UNION SPRINGS, ALA.—Bonds to the amount of $10,000 have been voted for improvements to the municipal electric light plant.

NATCHEZ, MISS.—The Natchez Oil Mill Company is reported to be in the market for a 75-kva. generator, a Corliss engine and considerable heavy motor equipment.

FOREMAN, ARK.—The Foreman Light & Water Company is reported to be considering new equipment for its light and water plant, to cost about $25,000.

NEW ORLEANS, LA.—The Southern Yacht Club is planning to erect a club house on Lake Pontchartrain. The tentative plans provide for a building, 300 ft. by 100 ft., the basement to contain heating plant, electric light and power plant and refrigerating plant. The cost is estimated at $200,000.

ALVA, OKLA.—The Southwestern Utilities Company is contemplating improvements to its electric light and power service in Alva.

NORMAN, OKLA.—An election will be held to vote on the proposal to issue $75,000 in bonds to establish a municipal electric light plant in Norman. The city may construct or purchase a plant.

PERRY, OKLA.—The City Council is considering improvements to the electric light plant and waterworks system, to cost about $100,000.

STILLWATER, OKLA.—The city of Stillwater is contemplating the installation of a new pumping station. The Mackintosh-Walton Company, State National Bank Building, Oklahoma City, is engineer.

WOODWARD, OKLA. — Bonds to the amount of $30,000 have been voted, the proceeds to be used to equip an electric light plant and waterworks system.

BURKBURNETT, TEX.—The Wichita Falls (Tex.) Electric Company is planning to enlarge its plant to supply electricity for the town of Burkburnett and also to operate well-drilling rigs.

Pacific and Mountain States

EVERETT, WASH.—A special election, it is reported, will be held in the near future to vote on the proposal to establish a municipal electric light plant in Everett. Investigations for the development of power on the Sultan River have been made by the City Commission. Plans for the initial development call for 6000 hp.

YAKIMA, WASH.—A power development of about 10,000 hp. in the Wapato project is included in the plans of the United States Indian Service. Power from this source will be available only during the irrigation season.

LEBANON, ORE.—The Lebanon Light & Water Company has purchased a site on which it proposes to erect a new power plant. The old plant will be used for a pumping station.

EL CENTRO, CAL.—Arrangements have been completed by the Holton Power Company for remodeling its plant at Sixth and Main Streets.

ELSINORE, CAL.—Application has been made to the State Water Commission by G. I. Lamy, engineer, Marsh-Strong Building, Los Angeles, for permission to appropriate 120 second-feet of water of Lake Elsinore to irrigate 20,000 acres of land. The plans include the construction of 42 miles of canal, with power and pumping plant.

FRESNO, CAL.—Surveys are now being made by the San Joaquin Light & Power Corporation for the construction of another large power plant on the San Joaquin River, to cost about $1,750,000. The new station will be located about 6 miles below the present station and will have an output of 20,000 hp.

MERCED, CAL.—Plans are being prepared by Allison & Allison, architects, 1405 Hibernian Building, Los Angeles, for a group of buildings for the Merced Union High School district, consisting of academic, administration and assembly building, domestic science, manual training and commerce building, power house and gymnasium. About $130,000 is available for the project.

SALESVILLE, MONT. — A project is under way for the installation of a hydroelectric power plant on Big Bear Creek, 5 miles south of here, to furnish electricity for lamps and motors in Salesville and to the farmers in this district.

LORDSBURG, N. M.—The purchase of a 1000-hp. boiler, a 1000-hp. steam turbine and steam equipment is reported under consideration by the Eighty Five Mining Company.

Canada

VANCOUVER, B. C.—The Pacific Electric Welder & Manufacturing Company, 1018 First Avenue, Seattle, Wash., contemplates the construction of a factory on Industrial Island, to cost, including machinery, between $60,000 and $70,000.

WINNIPEG, MAN.—Extensions to the municipal hydroelectric plant are under consideration.

ALLENFORD, ONT.—The installation of a hydroelectric system is under consideration by the Bruce County Council.

COLLINGWOOD, ONT.—Plans are under consideration to equip the Collingwood shipbuilding plant for electrical operation.

PARRY SOUND, ONT.—The installation of a new municipal electric light plant, to cost about $125,000, is reported under consideration. F. Murray is town engineer.

TORONTO, ONT.—Extensions to the lighting system, to cost about $100,000, have been recommended by the Property Commissioner.

MONTREAL, QUE.—Plans have been prepared by the Montreal Tramways Company for the erection of a substation on Cute Street, to cost $400,000, and also car barns on Fullum and Mount Royal Streets, to cost $110,000. W. Graves, Tramways Building, is chief engineer.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 14, 1919)

1,290,915. ARC-WELDING SYSTEM; Leonard P. Coulter, Milwaukee, Wis. App. filed April 4, 1914. Prevents excessive current at start and eliminates power waste.

1,290,917. REGULATION OF ELECTRICAL SYSTEMS; Gorham Crosby, Glen Ridge, N. J. App. filed June 24, 1915. Secondary series resistance utilized when voltage generated is excessive of battery voltage of a variable-speed generator.

1,290,928. THERMO CIRCUIT CLOSER; Frederick S. Denison, Minneapolis, Minn. App. filed May 3, 1917. Controls dampers of heating apparatus.

1,290,930. INCANDESCENT ARC LAMP; Philip K. Devers, Jr., Lynn, Mass. App. filed March 6, 1916. Resistance heater located adjacent to arcing space used for starting arc.

1,290,945. ELECTRIC SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed July 8, 1915. Employs pole-changing for obtaining increased motor torque for reversal.

1,290,946. ELECTRIC SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed July 8, 1915. See above patent.

1,290,957. SYSTEM FOR THE TRANSMISSION OF WRITING AND THE LIKE IN FACSIMILE; Herman Foss, Tjomo, and H. Petersen, Christiania, Norway. App. filed May 8, 1917. Generator at receiving station provides energy for recorder.

1,290,995. TESTING DEVICE FOR IGNITION SYSTEMS; Clara H. B. Holmes and O. G. Holmes, Cleveland, Ohio. App. filed Jan. 21, 1918. Plugs tested under pressure.

1,290,996. ELECTRIC WELDING MACHINE; Henry S. Holmes, Brooklyn, N. Y. App. filed Aug. 17, 1918. For projectile vanes.

1,290,997. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; Henry S. Holmes, Brooklyn, N. Y. App. filed Aug. 17, 1918. For hand grenades.

1,291,010. SAFETY INDICATOR AND LICENSE BRACKET; Nels M. Johnson and Thomas S. Quin, Chicago, Ill. App. filed July 31, 1916. For automobiles.

1,291,035. BRAKE APPARATUS; David L. Lindquist, Yonkers, N. Y. App. filed Jan. 22, 1916. Insures quick release of brake on elevators.

1,291,039. CIRCUIT MAKER AND BREAKER; Fritz Lowenstein and Joseph Broich, Brooklyn, N. Y. App. filed Nov. 29, 1916. For relay keys used in radio communication.

1,291,051. SAFETY CHEST FOR CONTAINING VALUABLES; James L. McQuarrie, Montclair, N. J. App. filed July 17, 1913. Electrically protected.

1,291,056. FLOW METER; Harold H. Mapelsden, Schenectady, N. Y. App. filed Aug. 10, 1916. Indicating meter has uniform scale.

1,291,066. RECTIFIER SYSTEM; Frederick W. Meyer, Pittsburgh, Pa. App. filed June 20, 1914. Energy from plurality of induction motor secondaries may be rectified in same rectifier.

1,291,078. METHOD AND MEANS FOR THE OPERATION OF ELECTRICAL APPARATUS; Walter S. Moody, Pittsfield, Mass. App. filed Feb. 27, 1915. Prevents injury from line surges.

1,291,088. LOW-LEVEL INDICATOR AND ALARM; Alfred Newell, Ottawa, Ontario, Can. App. filed July 29, 1918. For gasoline tanks of automobiles.

1,291,097. IMPULSE STARTER FOR MAGNETOS; Pontus Ostenberg, Los Gatos, Cal. App. filed Oct. 25, 1917. Intensifies spark during starting period.

1,291,106. ELECTRICAL RESISTANCE; John H. Payne, Ballston Spa, New York. App. filed Nov. 21, 1917. For radio receiving systems.

1,291,107. DYNAMO; Carl E. Pearson, Lansing, Mich. App. filed Dec. 29, 1916. Intermediate brush machine for regulating voltage when charging batteries.

1,291,110. ENERGY METER FOR ALTERNATING ELECTRIC CURRENTS; Charles Perdrisat and Al. Peloux, Geneva, Switzerland. App. filed March 24, 1917. Operates on Ferraris rotating field principle.

1,291,111. SYSTEM OF DISTRIBUTION; John F. Peters, Edgewood Park, Pa. App. filed Oct. 6, 1915. Will not disturb adjacent communication lines.

1,291,121. APPARATUS FOR WIRELESS TELEGRAPHY; John St. V. Pletts, London, Eng. App. filed Nov. 9, 1917. Attracts attention of listening operator.

1,291,124. TELEGRAPH APPARATUS; Edwin Pope, Quebec, Quebec, Can. App. filed June 29, 1915. Messages automatically sent into line and automatically reproduced in duplicate at receiving station.

1,291,132. TROLLEY HARP; Solomon H. Rahhal, Detroit, Mich. App. filed Feb. 13, 1918. Wire-retaining device.

1,291,139. INSULATOR; Rudolph R. Reese, Startup, Wash. App. filed Aug. 8, 1917. Wire is clamped to insulator.

1,291,144. ELECTRIC MOTOR; Garret Rekers, Rochester, N. Y. App. filed Feb. 15, 1915. Universal motor easily reversed by means of switch.

1,291,167. STORAGE-BATTERY ELECTRODE AND PROCESS OF MAKING SAME; Earl J. Rueb, Oklahoma, Oklahoma. App. filed July 24, 1917. Durable and not likely to deteriorate.

1,291,174. INTERRUPTING DEVICE FOR MAGNETOS; Emile J. J. Salmson, Billancourt, France. App. filed March 27, 1918. Mounted in an independent cage, affording facility for repairs.

1,291,197. CURRENT DETERMINATOR AND INDICATOR; Milton H. Shoenberg, San Francisco, Cal. App. filed Aug. 13, 1917. Easily used.

1,291,204. CONTROL SYSTEM; Karl A. Simmon, Edgewood Park, Pa. App. filed Jan. 23, 1915. For electric railway vehicles.

1,291,209. ELECTRIC, GAS OR VAPOR LAMP; Franz Skaupy, Berlin, Germany. App. filed June 9, 1916. Arc does not touch walls of tube.

1,291,216. MAGNETO-GENERATOR; Reuben S. Smith, Milwaukee, Wis. App. filed Sept. 2, 1916. Field revolves about stationary armature.

1,291,217. ADJUSTABLE SUSPENSION INSULATOR; Sol S. Sonneborn, Brooklyn, N. Y. App. filed Feb. 10, 1917. Distance between insulators may be varied.

1,291,218. UNIVERSALLY GRADABLE SUSPENSION INSULATOR; Sol S. Sonneborn, Brooklyn, N. Y. App. filed Aug. 25, 1917. See preceding patent.

1,291,232. DYNAMO-ELECTRIC MACHINE; Norman W. Storer, Pittsburgh, Pa. App. filed Aug. 9, 1915. Multiple-armature generator in which field magnet is divided.

1,291,233. CONTROL SYSTEM; Norman W. Storer, Pittsburgh, Pa. App. filed Oct. 27, 1915. For electric vehicles.

1,291,234. SPARKING DEVICE FOR INTERNAL-COMBUSTION ENGINES; Ole O. Storle, Tacoma, Wash. App. filed Dec. 22, 1916. "Make-and-break" type.

1,291,247. TELGRAPH REPEATER; Alston D. Taylor, Omaha, Neb. App. filed Aug. 28, 1914. Repeating effected by energy from main or line circuits.

1,291,253. DIAPHRAGM OR SEPARATOR; Charles J. Thatcher, New York, N. Y. App. filed March 22, 1915. For use in electrolytic cell.

1,291,263. DYNAMO-ELECTRIC MACHINE; Edwin G. Tidlund, Pittsburgh, Pa. App. filed Jan. 10, 1916. Light-weight motor for electric railways.

1,291,268. ELECTRICAL FITTING; Fritz Tresselt, Passaic Park, N. J. App. filed June 22, 1917. Outlet-box terminal.

1,291,283. BURGLAR-ALARM DEVICE; Robert W. Vail, New York, N. Y. App. filed Aug. 7, 1916. Does not hinder passage of authorized person.

1,291,297. CONNECTOR; Stanley Walas, Chicago, Ill. App. filed May 18, 1915. Nut of binding post need not be removed.

1,291,310. COMPOSITION FOR ELECTROLYTES FOR ELECTRICAL ETCHING; Joseph H. Weeks, Rutledge, Pa. App. filed April 4, 1917. Principal active element a chloride or chlorides.

1,291,318. RAZOR; Frank White, St. Louis, Mo. App. filed June 8, 1916. Mild current supplied to razor.

1,291,337. APPARATUS FOR AND METHOD OF PLATING WITH METAL; John E. Woodbury, Worcester, Mass. App. filed May 29, 1915. For facing type with hard metal.

1,291,379. THERMIONIC CONVERTER; Wilfred T. Birdsall, Montclair, N. J. App. filed Jan. 10, 1916. Attains pure electron discharge.

1,291,386. LIGHTNING ARRESTER; Quincy A. Brackett, Pittsburgh, Pa. App. filed April 29, 1915. Choke-coil type.

1,291,406. ELECTRIC CONDUCTOR; Edwin D. Chaplin, New York, N. Y. App. filed Feb. 8, 1915. Fireproof and waterproof.

1,291,422. CONTROLLER FOR ARC-WELDING APPARATUS AND THE LIKE; Leonard P. Coulter, Milwaukee, Wis. App. filed April 4, 1914. Controlling apparatus functions with movement of electrodes.

1,291,423. ELECTRIC HAND GRILL; Jay D. Crary, Aberdeen, Wash. App. filed Oct. 10, 1917. May be used with broiler.

1,291,424. DYNAMO-ELECTRIC MACHINE; Frederick Creedy, Ilkley, Eng. App. filed July 20, 1915. Varies pole number by varying phase difference between zones.

1,291,441. ELECTRON VALVE; Harold P. Donle, Meriden, Conn. App. filed Aug. 8, 1918. Durable and simple.

1,291,443. SAFETY DEVICE FOR ELECTRIC CIRCUITS; Herbert G. Dorsey, Dayton, Ohio. App. filed Jan. 28, 1916. Automatic means of grounding appliances.

1,291,459. DYNAMO-ELECTRIC MACHINE; Allan B. Field, Marple, Eng. App. filed Sept. 10, 1914. Multiple-layer armature winding easily cooled.

1,291,460. ELECTRIC WIRING CONNECTOR; Charles W. Finley, Battle Creek, Mich. App. filed April 13, 1918. Neat appearing and easy to installed.

1,291,473. AUXILIARY TIME KEY FOR SELECTIVE RAILWAY SIGNALING SYSTEMS; Maurice F. Gerr, Irondequoit, N. Y. App. filed July 23, 1915. Does not require attention of operator at central station.

1,291,483. PORTABLE ELECTRIC LANTERN; William Grether, Dayton, Ohio. App. filed July 27, 1918. Battery securely yet removably connected to bulb.

1,291,501. ELECTRIC WELDER; Austin S. Hatch, Detroit, Mich. App. filed April 22, 1918. Movable upper electrode arm operated by treadle.

1,291,507. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 9, 1915. For electric railway vehicles.

1,291,508. CONTROL SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 25, 1914. Prevents flashover in dynamo-electric machines.

1,291,512. PROTECTIVE DEVICE; Edward M. Hewlett, Schenectady, N. Y. App. filed Aug. 7, 1913. Retains characteristics and mode of operation in spite of extreme conditions upon circuit.

1,291,527. WIRELESS RECEIVING SYSTEM; Albert W. Hull, Schenectady, N. Y. App. filed March 10, 1917. Sensitiveness and selectivity of receiving circuit increased.

1,291,538. WIRE SPLICE; Silas R. Jones, Coeburn, Va. App. filed June 19, 1918. For electric trolley wires.

1,291,545. CONNECTOR FOR ELECTRIC CONDUCTORS; Chester A. W. Keim, West Orange, N. J. App. filed March 20, 1918. One terminal consists of spring jaws engaging other terminal at right angles.

1,291,561. CONTROL FOR ELECTRIC ELEVATORS; David C. Larson, Yonkers, N. Y. App. filed Oct. 2, 1914. Shunt field effects dynamic brake action.

1,291,568. COUPLER FOR ELECTRICAL MUSICAL INSTRUMENTS; Frederick B. Little, Chicago, Ill. App. filed March 13, 1916. Each key controls two sound switches, one being optionally used.

1,291,583. CONTROL SYSTEM; Paul L. Mardis, Altoona, and Andrew H. Candee, Pittsburgh, Pa. App. filed Sept. 9, 1916. For operating electric vehicles in trains.

1,291,585. TELEPHONE TRUNKING SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Dec. 2, 1910. Combined trunk selector and repeater for three-wire systems.

1,291,586. TRUNKING AND SUPERVISORY SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Dec. 10, 1910. Combined selector and repeater furnished for connecting two-wire with three-wire systems.